

Egyptian Journal Of Ear, Nose, Throat And Allied Sciences

Volume No. 26

Issue No. 3

September - December 2025



ENRICHED PUBLICATIONS PVT.LTD

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Egyptian Journal Of Ear, Nose, Throat And Allied Sciences

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To expand activities with regional and international scientific societies

Egyptian Journal Of Ear, Nose, Throat And Allied Sciences

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Egyptian Journal Of Ear, Nose, Throat And Allied Sciences

(Volume No. 26, Issue No. 3, September - December 2025)

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The Effect of Injection of Saline Adrenaline (1/100000) 15ml versus 5ml on the Intraoperative Skin Edema and Thickness during Rhinoplasty

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ABSTRACT

Background: Nasal skin edema is a common result of soft and bony tissue trauma during rhinoplasty. In a cosmetic surgery like rhinoplasty, skin edema can fade the cosmetic results and can lead to dissatisfaction for both the surgeon and the patient. Local saline /adrenaline injection is claimed to reduce the nasal skin edema intraoperative.

Objective: To assess effect of injection of saline adrenaline (1/100000) 15ml versus 5ml on the skin oedema and thickness during rhinoplasty through thesis study.

Patients and Methods: In this study 60 cases of rhinoplasty will be operated, 30 cases will be injected by saline adrenaline (1/100000) of 5ml and the others 30 cases will be injected by saline adrenaline (1/100000) of 15 ml, then measuring the skin oedema after 10 minutes of saline adrenaline (1/100000) injection, after 30 minutes and after 60 minutes of the injection at three sites; the dorsum, supratip and the tip of the nose by Seal Gouge Caliper (surgical caliber).

Results: The intraoperative skin edema was significantly decreased with local injection of large amount (15ml) of saline / adrenaline 1/100000 than the usual injected amount (5ml) saline /adrenaline 1/100000 specially at the tip and the supratip of the nose and specially at 30 min and 60 min after injection, but statistically significance difference only at 60min at the dorsum.

Conclusion: That the skin oedema much less with injection of 15ml of saline adrenaline (1/100000) in comparison to injection of 5ml of saline adrenaline (1/100000).

Key Words: Adrenaline, edema, rhinoplasty, skin thickness.

INTRODUCTION

With increasing demands for plastic surgery in recent years, the number of rhinoplasties has also shown an upward trend. The anatomy of the nose, with its vascular structure and limited area for maneuvering, restricts the surgeon's access and visibility during a rhinoplasty. Therefore, most surgeons have been using saline/adrenaline with local anesthetics as a way to prepare the region for operation. Indeed, this method has become a standard procedure and current practice for most plastic surgeons[1].

Infiltration of solutions with adrenaline concentration of 1:100,000–1:200,000 are commonly used while solutions with the concentration of 1:10,000 are commonly used just for topical applications[2, 3]. Also, infiltration of those agents provide mucoperichondrial flap elevation through hydrodissection in the septorhinoplasty surgery.

This study was designed to compare between the effect of injection 15ml of saline /adrenaline (1/100000) with the effect of injection of 5ml of saline /adrenaline (1/100000) on the nasal skin edema intraoperatively in rhinoplasty.

Objective:

To assess effect of injection of saline adrenaline (1/100000) 15ml versus 5ml on the skin oedema and thickness during rhinoplasty through thesis study.

PATIENTS AND METHODS:

A prospective double arm clinical trial study was carried at operating theatre of ENT department Ain Shams University Hospitals, starting from June 2018 till June 2019, 60 patients were included in our study.

Inclusion criteria:

Patients presented to ENT clinic in Ain Shams university hospitals with deformed nose candidates for rhinoplasty

No sex predilection.

Age group: ranges from 20 to 40 years.

Exclusion criteria:

Revision rhinoplasty.

Patient with skin diseases.

Collagen disease.

Patient with any contraindication for adrenaline injection.

Study tools and procedures:

1. Detailed explanation of the procedure and taking an informed consent from the patients.
2. All patients subjected to detailed history taking prior to the surgery.
3. Sixty cases of rhinoplasty patients operated by the same surgical team. 30 cases have been injected by saline adrenaline (1/100000) of 5ml and the other 30 cases have been injected by saline adrenaline (1/100000) of 15 ml using a 22gauge needle. The injection was done in two components: a picture frame block to reduce the regional blood supply and then the specific areas of surgery.
4. Assessment of the skin oedema was done after 10 minutes of saline adrenaline injection, then 30 minutes and lastly, after 60 minutes of the injection using surgical caliber.

5. This measurement has been done after marking six dots at three sites; the dorsum, supratip and the tip of the nose. After that the skin fold in these areas was measured using Seal Gouge Caliper (Figure 1).



Fig. 1: Measurement of the skin fold at the dorsum, supratip and the tip of the nose respectively.

Statistical Analysis:

Data were collected, revised, coded and entered to the Statistical Package for Social Science (IBM SPSS) version 23. The quantitative data were presented as mean, standard deviations and ranges when their distribution found parametric. Also, qualitative variables were presented as number and percentages. The comparison between groups regarding qualitative data was done by using Chi-square test.

RESULTS:

Sixty patients were included in this study. Patients ranged in age from 21:39 years (mean: 29.87 years), 56.7% were females and the rest were males (43.3%).

There was no significant statistical difference in the skin oedema at the dorsum of the nose between the two groups after 10 min and 30 min (P value 0.639, 0.100 respectively).

There was significant statistical difference in the skin oedema at the dorsum of the nose between the two groups after 60 min (P value: 0.011).

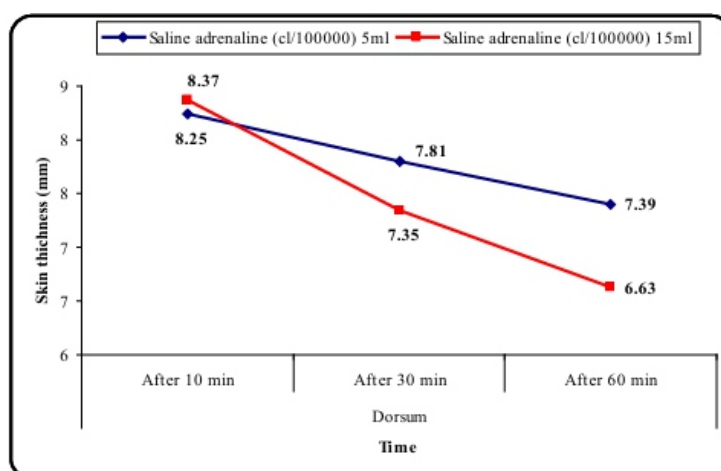


Fig. 2: The effect of injection of Saline adrenaline (1/100000) 5ml versus 15 ml on the dorsum.

There was no significant statistical difference in the skin oedema at the supratip of the nose between the two groups after 10 min (P value 0.82). But there was highly significant statistical difference in the skin oedema at the supratip of the nose between the two groups after 30 and 60 min (P value: 0.06 and 0.001 respectively).

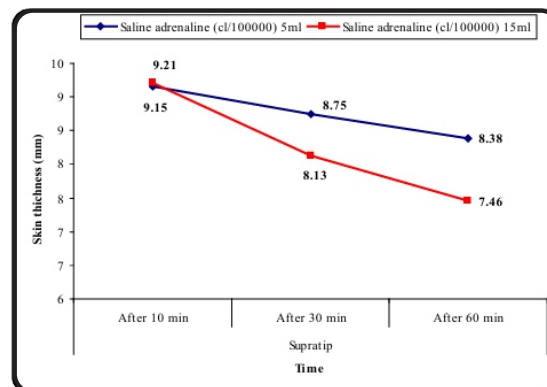


Fig. 3: The effect of injection of Saline adrenaline (1/100000) 5ml versus 15 ml on the supratip

There was no significant statistical difference in the skin oedema at the tip of the nose between the two groups after 10 min (P value 0.36). There was highly significant statistical difference in the skin oedema at the tip of the nose between the two groups after 30 and 60 min (P value: less than 0.001).

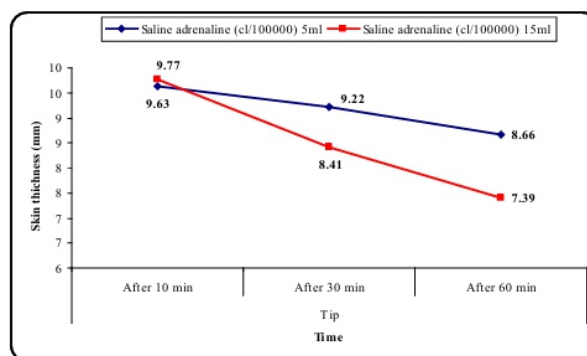


Fig. 4: The effect of injection of Saline adrenaline (1/100000) 5ml versus 15 ml on the tip.

DISCUSSION

In a cosmetic surgery like rhinoplasty, nasal skin edema can fade the cosmetic results and can lead to dissatisfaction for both the surgeon and the patient. Many attempts have been undertaken to minimize these morbidities[4].

Nasal skin edema is a common result of soft and bony tissue trauma during rhinoplasty. The nasal vascular structures include a subdermal vascular plexus, lymphatic vessels, veins and arteries. Histopathological studies have revealed that the nose has two dissection planes: a subcutaneous plane and a deep areolar tissue plane. After surgical disruption of the venous and lymphatic vasculature, edema develops because levels of interstitial fluid and bleeding in soft tissues exceed the capacity of drainage to lymphatic and venous systems[5]. Notably, dissection performed under the musculoaponeurotic plane reduces the severity of vascular injury[6].

Local saline adrenaline is advised for easy dissection, reduction in the degree of edema, and clear dissection under both local and general anesthesia[7]. The authors observed that Local saline adrenaline infiltration provides easier and cleaner dissection at the tip of the nose. All the operations were conducted under general anesthesia. Adrenaline has two opposite effects on the vessels. It acts directly on α and β adrenergic receptors. Stimulation of α adrenergic receptors located in blood vessels causes vasoconstriction, whereas stimulation of β -adrenergic receptors causes vasodilation. Responses to adrenaline are both site/receptor and concentration dependent.

Whilst adrenaline leads to vasodilation at low doses, it causes vasoconstriction at high doses[8].

Adrenaline is really a sympathomimetic amine with each α as well as β -adrenergic receptor agonist effects. Skin, mucosa, as well as kidney arterioles display vasoconstriction on account of α -receptor predominant activation. Low concentrations of adrenaline lead to preferential β_2 receptor activation leading to vasodilatation in bronchiolar smooth muscle while increased ranges activate α -receptor-mediated vasoconstriction in vascular smooth muscle[9].

Our results show that intraoperative skin edema was significantly decreased with local injection of large amount (15ml) of saline /adrenaline 1/100000 than the usual injected amount (5ml) saline /adrenaline 1/100000 specially at the tip and the supratip of the nose and specially at 30 min and 60 min after injection, this potentially improves the surgical outcome and give better correction of nasal deformities.

In GUN's study in Turkey on 48 patients, they investigated the effects of lidocaine/adrenaline combination injection on postoperative edema/ ecchymosis in rhinoplasty. 2 ml of 2% lidocaine with 1:100,000 adrenaline solution was applied at a random side of the nose prior to the lateral osteotomy. The opposite side was used as a control. Lidocaine / adrenaline was infiltrated to lateral osteotomy site and was applied to the tip and the columellar regions. The relationship between edema/ecchymosis and the degree of lidocaine/adrenaline combination on the injected and uninjected sides was evaluated on the first, third and seventh day postoperatively[10].

All patients experienced some degree of periorbital edema and ecchymosis. Edema and ecchymosis decreased daily in the majority of patients. Edema and ecchymosis were not observed on the seventh day. Grade IV (massive edema with the eyelid swollen shut) edema and ecchymosis were not seen in any patient, there were no significant differences between the lidocaine/adrenaline combination in injected and uninjected sides with regard to edema and ecchymosis on the first, third or seventh days[10].

In a randomized control pilot study. KalantarHormozis, et al., (2011) aimed at showing that epinephrine can be avoided in local anesthetic solution used for rhinoplasty. Patients were randomized to either the intervention group (N = 39) which received (only lidocaine injection) or the control group (N = 74) which received (lidocaine with epinephrine). They reported that elimination of epinephrine for a few patients in the intervention group reduced the number of anticipated cardiac-related complications. Furthermore, elimination of epinephrine did not add any additional risk of bleeding assessed intraoperatively by sponge count and total aspirate. And also showed that elimination of epinephrine reduced the length of surgery in the intervention group, which could be partly due to the 5-10 min saved by not having to inject the lidocaine/epinephrine. These findings raise the possibility that elimination of epinephrine during the rhinoplasty could be an alternative procedure that may in fact lead to the same surgery outcome if not a better one[11].

Matoušek's study results show that: the topical administration of adrenalin on nasal mucosa in 1:10,000 dilution resulted in a systemic absorption. The amount of adrenalin, which was absorbed, was relatively low, the adrenalin levels in blood reached two-fold higher levels than the basal concentration. No changes were observed in blood pressure[12].

In this study we demonstrated the effect of adrenaline injection on the skin of the nose, which reduces swelling during the rhinoplasty, which leads to good judgment on the shape of the nose during the operation. There is no study was found reporting the effect of the amount of local saline /adrenaline on the nasal skin oedema intraoperative and how to reduce nasal skin oedema of the nose during rhinoplasty. Most studies discuss the postoperative edema.

Our study was limited by small sample size. Studies with a larger sample size can help further substantiate these findings.

Other methods described by different authors to decrease the perioperative edema and ecchymosis as using intraoperative systemic steroid[13], Also, Compression of the nasal dorsum with ice cooled, wet swabs[14].

CONCLUSION

The available data shows that the intraoperative skin oedema in rhinoplasty operation much less with injection of 15ml of saline adrenaline (1/100000) in comparison to injection of 5ml of saline adrenaline (1/100000), Studies with a larger sample size can help further and substantiate these findings.

ACKNOWLEDGMENTS

The authors are grateful to Dr. Enrico Robotti as the idea of this study was acquired from his technique in rhinoplasty.

ETHICAL

Ethical approval of the Scientific and Ethical Committee of Ain-Shams University was obtained.

CONFLICT OF INTEREST

There are no conflicts of interest.

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Effect of Articulation Disorders on Interpretation of Word Recognition Scores in Hearing Impaired Children with Cochlear Implant

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ABSTRACT

Objectives: Speech recognition tests are used to explain the accuracy of patient auditory reception and processing of speech material. There will be a problem when testing children because their speech recognition scores are affected by their level of language development and their auditory capabilities. This prospective study was designed to compare word recognition test scores -Arabic version- before and after phoniatric evaluation and application of Arabic articulation test in children using cochlear implant aiming at evaluating effect of articulation disorders on interpretation of word recognition scores.

Methods: Forty-six children enrolled in Med El cochlear implant program divided into 4 groups according to language assessment. Aided word recognition test was performed before and after application of Arabic articulation test that detects speech and articulation errors including substitution, phonological processes, right words and wrong words.

Results: Scores of word recognition test of study groups were improved after phoniatric evaluation and application of articulation test and reflected the importance of duration of language rehabilitation and use of cochlear implant.

Conclusion: Speech production errors could contaminate the results of open-set speech perception tests and the application of standardized articulation test aids in real estimation of word recognition in children with cochlear implant.

Key Words: Auditory perception; cochlear implant; hearing impairment; speech articulation; word recognition.

INTRODUCTION

Today, Cochlear implant (CI) is considered the solution of severe to profound hearing-impaired adults and children. CI is performed for a wide variety of causes leads to hearing loss[1]. Auditory stimulation from a CI early in life should be expected to influence most cognitive functions as a consequence of the plasticity of the brain in a young child[2].

Language as an outcome measure for assessment of a medical/surgical intervention was a new concept which was rapidly assimilated into the care of the prelingually deafened child. Children with hearing impairment show delays in verbal semantic ability throughout the developmental period. They show difficulty in using concept words, figurative and multiple meanings. In addition to troubles in

understanding connected discourse in both spoken and written modes[3]. In addition, they always have element of delayed language development in all parameters (semantics, syntax, pragmatics & phonology), with decreased vocabulary size at word level together with decreased ability to utter complete sentences with complete phrase at sentence formulation level (sentence simplification)[4].

Speech perception and production are the main goals for CI. Previous studies showed a large variability in speech perception abilities in users of CI because of many factors[5,6,7]. In the first years after the advent of CI, many authors have assessed speech perception skills in CI users many frequently. Today, the used speech assessment batteries of hearing in adults and children using CI consist of monosyllabic words and sentences presented either in quiet and noisy situations[8,9]. The Phonetically Balanced Kindergarten (PBKG) Word Test[10] is still one of the most commonly used tests to assess speech perception abilities in hearing impaired children. An Arabic version of PBKG word lists was developed in 1984[11].

Speech recognition tests are used to explain the accuracy of patient auditory reception and processing of speech material. There will be a problem when testing children because their speech recognition scores are affected by their level of language development and their auditory capabilities[12]. There is currently considerable discussion about the difficulties seen in speech recognition tests whether they are due to a low-level deficit affecting auditory discrimination, or they reflect impairment of a specialized language processing system[13].

Speech production disorders affects interpretation of word recognition (WR) test that may affect scores in either over or under estimation way. Accordingly, this prospective study was designed to compare WR test scores -Arabic version- before and after phoniatic evaluation in children using CI. Phoniatic evaluation detected speech production disorders that may affect percent correct scores of WR test.

PATIENTS AND METHODS

Patients

The study group consisted of 46 children with profound SNHL enrolled in Med El CI program. The study was conducted in Audiology unit at Otorhinolaryngology Department. They were programmed initially using behavioral programs.

Inclusion criteria included children 4 to 6 years old using CI with satisfactory aided response, average and above average IQ and receiving aural and oral rehabilitation.

Hearing impaired children with other causes of velopharyngeal insufficiency was excluded from the study including children with cleft palate, post- adenotonsillectomy and neurologically affected children.

This study was performed after fulfilling the requirements of the ethical committee at the ENT Department and the approval of the Institutional Research Board of the Faculty of Medicine in our University. Written informed consent was also obtained from all the patients who participated in this study. All patients presented written informed consent in accordance with the Declaration of Helsinki.

Equipment

1. Computer based programming Software and a programming unit for MED-EL (MAESTRO) cochlear implant device
2. Two channel pure tone diagnostic audiometer model (Madsen Itera II)
3. Sound treated room (locally made).

Method

1. Full medical and otologic history.
2. Otologic examination.
3. Aided audiological evaluation: using warble tones in a sound field at 0.5, 1, 2 and 4kHz. presented via loudspeakers placed at a 45 degrees azimuth at a distance of one meter from the child. The child response to sound was obtained using visual reinforcement audiometry or conditioned play audiometry. According to the aided thresholds, satisfactory aided response was considered using pure tone threshold better than 40dB at each tested frequency.
4. Aided WR test: using Arabic version of PBKG word lists (Soliman and Elmahalawi, 1984) delivered via a sound field of 55 dB HL. Arabic version of PBKG word lists was used to assess percent correct score for word recognition. It is an open set test composed of 8 lists. Each list is composed of 25 CVC or CVCC monosyllabic words. Items of each list are phonetically balanced.
5. Complete phoniatic evaluation.

Language assessment using the Preschool Language Scale-4 "Arabic Version"[14] for determination of language age. Language ability of the children were classified into 4 groups:

- Group 1: CI children uttering single words.
- Group 2: CI children uttering simple sentences (2 words sentence)
- Group 3: CI children uttering complete sentences (3-4 words sentence)
- Group 4: CI children uttering long sentences.

Mansoura Arabic Articulation Test [M.A.A.T.][15] for detection any speech disorders (fixed disorder and phonological processes). A 106 pictures-naming test was designed to elicit spontaneous single word responses representing all possible initial, middle, final and double positions of consonants and vowels. For facilitation of articulation test results, speech disorders divided into 4 categories: substitution, phonological processes, right words and wrong words.

Aided WR test after phoniatric evaluation: corrections of scoring of WR after correlating speech disorders obtained by M.A.A.T with the Arabic version of PBKG word list. The results of M.A.A.T test included wrong words, substitution, phonological processes and right words. Speech disorders including substitution, phonological processes and right words was considered correct and included in percent correct scores of WR test.

RESULTS

There was no statistical significance difference among all groups as regards sex, age, duration of implantation and language rehabilitation (Table 1).

Descriptive analysis of Articulation test of each group as regards (wrong words, Substitution, phonological Process and Right words) was mentioned in (Table 2).

When scores of WR in each group before and after phoniatric evaluation were compared, there was statistically significant difference as shown in (Table 3). (Table 4) showed significant correlation between WR scores after phoniatric evaluation and duration of language rehabilitation and implantation.

Before phoniatric evaluation, there was statistically significant difference among all groups in WR scores. By pairwise comparison using Man Whitney test, there

was statistically significant difference between all groups except between group (1) and group (2) (Table 5). After phoniatric evaluation, there was statistically significant difference among all groups in WR scores. By pairwise comparison using Man Whitney test, there was significant difference between group (1) and group (3), group (1) and group (4) and group (2) and (4).

Table 1: Comparison among all groups according patient's characteristics

	Group (1) (N=10)		Group (2) (N=14)		Group (3) (N=11)		Group (4) (N=11)		Test of significance (p)
	%	No.	%	No.	%	No.	%	No.	
Sex									
Male	2	20	5	35.7	4	36.4	7	63.6	(MCP=.5)
Female	8	80	9	64.3	7	63.6	4	36.4	
Age (years)									
			Median (Min-Max)						(H=3.3, P=.189)
			5 (4.5 - 6)	4.5 (4 - 6)	5.5 (4 - 6)		6 (5 - 6)		
Duration of CI use (years)			1 (2m - 1.5)	1.5 (.5 - 3)	2 (1 - 2)		2 (.5 - 3)		(H=3.4, P=.189)
Duration of language rehabilitation (years)			1 (1m - 1.5)	1.5 (.5 - 2.5)	2 (1 - 2)		2 (.5 - 2.5)		(H=5.8, P=.12)

MCP: Monte Carlo Exact p value - H; Kruskal Wallis test - N: number - M: month

Table 2: Descriptive analysis of M.A.A.T results of each study group

	Group (1) (N=10)	Group (2) (N=14)	Group (3) (N=11)	Group (4) (N=11)
Wrong words Median (Min -Max)	18 (8-20)	12.5(5-17)	7 (4 -14)	5(1 -8)
Substitution Median (Min -Max)	3(1 -5)	3(0-5)	2 (1 -7)	2 (0 -3)
Phonological Process Median (Min -Max)	1.5 (0 -3)	7(3 -8)	3(1 -10)	4(2 -7)
Right Words Median (Min -Max)	3(2 -9)	3 (3- 7)	10 (3 -16)	15 (10 -18)

Table 3: Comparison between WR scores before and after M.A.A.T test in each study group

	Percent correct scores of WR before M.A.A.T test	Percent correct scores of WR after M.A.A.T test	Test of significance (p)
Group (1) Median (Min -Max)	12(8 -36)	28(20 -68)	(z = -2.8, P=.005*)
Group (2) Median (Min -Max)	12(12 -28)	50(32 -80)	(z = - 3.3, P=.001*)
Group (3) Median (Min -Max)	40(12 -64)	72(44 -84)	(z = -2.9, P=.003*)
Group (4) Median (Min -Max)	60 (40 -72)	80 (68 -96)	(z = -2.9, P=.003*)

Z; Wilcoxon Test

- *: statistically significant.

Table 4: Correlation of percent correct scores of WR before and after M.A.A.T test with age, duration of language therapy and duration of implantation

	WR scores before M.A.A.T test	Age	Duration of language therapy	Duration of CI use
WR scores before M.A.A.T test	(r) 1	.249	.156	.169
	P	.096	.301	.26
WR scores after M.A.A.T test	(r) 1	.16	.277	.296
	P	.28	.06*	.046*

r: Spearman Correlation.

- *: statistically significant.

Table 5: Comparison of WR scores among all groups before and after M.A.A.T tes

	Group (1)	Group (2)	Group (3)	Group (4)	Test of significance (p)
Percent correct scores of WR before M.A.A.T test: Median (Min -Max)	12 (8 -36)	12 (12 -28)	40 (12 -64)	60 (40 -72)	(H=31.6, P=.0001*)
P1	1				
P2			.007*		
P3				.0001*	
P4		.023*			
P5		.0001*			
P6			.08		
Percent correct scores of WR after M.A.A.T test: Median (Min -Max)	28 (20 -68)	50 (32 -80)	72 (44 -84)	80 (68 -96)	(H=30.99, P=.0001*)
P1	.273				
P2			.002*		
P3				.0001*	
P4		.336			
P5		.002*			
P6			.64		

H; Kruskal Wallis test

P: Significance among all groups assessed by Man Whitney test; p1 Significance between group 1 and group 2, P2: Significance between group1 and group 3, p3: Significance between group1 and group 4, p4: Significance between group2 and group3, p5: Significance between group2 and group4, p 6: Significance between group3 and group 4.

- *: statistically significant.

DISCUSSION

The present study was a prospective cross-sectional study conducted on 46 hearing impaired children fitted with MED El CI Opus 2. Although study groups did not show significant difference in age, duration of implantation and language therapy (Table 1), WR scores differed significantly before and after phoniatric evaluation and application of articulation test (Table 3&5). In Table (5) before application of articulation test, the statistically significant difference between all groups except between group (1) and group (2) in WR scores could be explained by the percentage of wrong word that are the least in group (4) as shown in Table (2). The significant difference and accordingly improved scores of word recognition after application of articulation test was our hypothesis the present study (Table 3). Hearing impaired children can develop speech but still have many articulation errors in their speech and

the examiner cannot precisely detect these errors than can lead to either over or under estimation of word recognition scores. The application of articulation test by phonetician can help in avoiding word recognition scores errors.

Many authors reported that word scores vary widely in the majority of children with CI. Several trials have been made to explain such difference in order to predict performance after CI. Age at onset and duration of hearing loss, residual hearing, course of hearing loss and the regular use of hearing aids are considerable factors that affects speech performance in CI users. In addition, the etiology of hearing loss and its relation to speech performance is questionable[16,17,18].

The WR test performed by PBKJ words is an open-set test in which the child repeats the perceived words and examiner marked it as right or wrong word. This process can be contaminated by speech errors of the child and the scores of WR test can be over or underestimated- according to the present study, Table (2) described speech errors in study groups- this idea was obvious in the present study after application of articulation test and corrections of WR scores obtained before phoniatic evaluation (Table 3). In Table (3), each group showed statistically significant difference regarding the speech discrimination score before and after phoniatic evaluation($p>0.05$ for all). But to our best knowledge, no papers discussed this issue until now.

Correlation of scores of WR before and after phoniatic evaluation with age, duration of CI and language therapy showed that scores of WR after phoniatic evaluation were related to duration of CI and language therapy (Table 4). Rönnerberg et al.[19] concluded that the age of identification and amplification, the amount and type of habilitation are from the weighting factors that contributed significantly to speech perception, speech production, and language outcomes. Accordingly, the scores of WR obtained after application of articulation test is the correct scores that reflectes real speech perception performance in CI users.

CONCLUSION

Speech perception abilities varies considerably in CI users because of many factors. Speech production errors could contaminate the results of open-set speech perception tests and the application of standardized articulation test aids in real estimation of word recognition in children with CI.

It is important to mention the sample sizes for this study were small that affects the generalization of findings. The current study only evaluated few factors that might influence speech discrimination skills. To perform a more thorough assessment, it may be helpful to obtain information on other potential factors that might have an impact on speech discrimination abilities.

CONFLICT OF INTERESTS

There are no conflicts of interest.

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Voice Evaluation in Patients with Hyperthyroidism

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ABSTRACT

Background: Several studies reported voice changes in patients with thyroid disorders.

Objective: The objective of this study was to examine the voice characteristics of a group of patients with hyperthyroidism.

Patients and Methods: Twenty-one patients with clinical hyperthyroidism and Twenty-one healthy volunteers in the age range 24-55 years were subjected to voice assessment using both subjective (auditory perceptual assessment) and objective tools (acoustic and aerodynamic analyses).

Results: Despite the absence of perceptual voice changes in our patients with hyperthyroidism, subtle changes in the acoustic and aerodynamic parameters could be detected with a trend towards laryngeal dysfunction. Maximum phonation time and Harmonic/Noise ratio were significantly lower, and shimmer was significantly higher in hyperthyroid patients when compared to the reference group. Pitch and jitter were also higher in hyperthyroid patients, but the difference was not statistically significant.

Conclusion: These findings provide evidence that elevated levels of thyroid hormones potentially affect the phonatory function of the vocal folds.

Key Words: Acoustic; aerodynamic, hyperthyroidism; voice.

INTRODUCTION

Voice production by the human larynx is a highly specialized and organized function that depends on multiple systems, including a properly functioning nervous system, a healthy respiratory system, and a physiologically active upper airway tract[1]. Vocal quality is greatly affected by hormones. Even though plenty of hormones are produced in the body, sex hormones and thyroid hormones directly affect the voice[2].

The thyroid gland secretes thyroxine (T4) and triiodothyronine (T3) hormones that are important for synthesizing proteins and controlling basal metabolism[3]. Evidence has shown that thyroid hormone receptors are found in the laryngeal tissue, and this suggests that thyroid hormones are vital for laryngeal development, physiology, and function[4].

Hyperthyroidism results in multi-system affection. It usually causes fatigue, palpitations, tremors, sleep disturbance, anxiety, weight loss, heat intolerance, perspiration, and polydipsia[5]. Excess thyroid

hormone results in voice changes such as mild vocal instabilities, including "shaky" voice, breathy quality, and decreased loudness[6]. The symptoms of hypothyroidism are more subtle than those of hyperthyroidism, and voice changes are one of the well-known symptoms of hypothyroidism[7]. Studies have shown that voice changes are present in 27% of patients with hyperthyroidism and 2%-98% of patients with hypothyroidism[8].

The majority of studies on voice changes in thyroid patients have focused on the impact of hypothyroidism on vocal function or voice changes post-thyroidectomy. However, few studies investigated the effect of hyperthyroidism on voice. This study aimed to examine the voice characteristics of a group of patients with hyperthyroidism, which would allow for early detection and a better understanding of voice changes in these patients.

PATIENTS AND METHODS:

Study Design:

Observational comparative cross-sectional study from consecutive patients with clinical hyperthyroidism who were referred to the outpatient clinic of Phoniatrics from the endocrinology unit (internal medicine department).

Subjects:

This study was conducted on 42 patients in the age range 24-55 years, who were divided into two groups. The first group (the patient group) consisted of 21 patients with hyperthyroidism with a mean age of $39 (\pm 12)$ years. The reference group consisted of 21 healthy volunteers (with perceptually normal voice quality without thyroid disorder) with a mean age of $34.6 (\pm 6.6)$ years. The patient selection criteria were medical diagnosis of symptomatic hyperthyroidism, no history of previous surgical intervention in the neck or larynx, absence of other known causes of voice changes (such as vocal fold lesions, vocal fold paralysis, and current respiratory tract infection), patients did not receive previous voice therapy, and they were not smokers or ex-smokers. The patient group was further divided into two subgroups. The first subgroup comprised 11 patients with clinical hyperthyroidism under medical antithyroid treatment for no less than one month, in the form of carbimazole and beta-blocker. The second subgroup comprised 10 newly discovered patients with clinical hyperthyroidism but not started medical antithyroid treatment. The study was approved by the Institutional Research Board of Mansoura faculty of medicine. All participants signed a consent form.

Methods:

Hyperthyroidism diagnosis was made at the endocrinology unit, Internal Medicine department, and determination of hormones in serum (thyroid-stimulating hormone [TSH], triiodothyronine, thyroxine). The blood samples (3-5ml) were collected from each patient, centrifuged at 3000-5000 revolutions per minute where enzyme-linked immunosorbent assay (ELISA) by HUMAN diagnostics worldwide kits have been adopted as thyroid hormone assay method[9].

All participants were subjected to voice evaluation in the outpatient clinic of Phoniatrics at Mansoura University Hospital, using the following assessment protocol:

Subjective voice evaluation

Auditory perceptual assessments of voice (APA) were carried out using a modified GRBAS (Grade, Roughness, Breathiness, Aesthenia, Strain) scale[10] with four grades from 0 (normal) to 3 (severe dysphonia). A dynamic microphone and a laptop were used to record APA. Perceptual analysis was conducted by two phoniatricians experienced in the assessment of voice disorders.

Objective voice evaluation

Acoustic analysis was conducted in a quiet room with a dynamic microphone 3-cm from the subject's mouth. The subject was instructed to produce a prolonged /a/ sound recorded via a laptop. The middle portion of each vowel production was analyzed using PRAAT 64-bit edition[11] to determine the fundamental frequency (Hz), jitter (%), shimmer (%), and harmonic to noise (H/N) ratio (dB).

For aerodynamic analysis, maximum phonation time (MPT) was calculated using a stopwatch during the production of sustained /a/ sound at comfortable loudness and pitch after taking a deep breath.

Laryngoscopic examination of the patient group was performed with a 70° rigid endoscope. The laryngoscopic finding was bilateral normal vocal folds mobility and no pathological laryngeal lesions. Patients with abnormal laryngeal findings were excluded from the study.

Statistical Analysis:

Data entry and analysis were done by the statistical package of social sciences "SPSS" version 23. Qualitative variables were summarized in number & percent. Chisquare test was used to compare qualitative variables in different groups. Quantitative variables were described as mean & standard deviation for normally distributed data. The median, minimum, and maximum were used to describe non-normally distributed data. The ShapiroWilk test was employed to determine whether the data had a normal distribution. An independent t-test was used to compare two different means and a one-way ANOVA to compare three different means. For nonnormally-distributed data, the Mann-Whitney test was used to compare variables in two different groups and the Kruskal Wallis test in three different groups. Statistical significance is defined as a level of significance less than 0.05.

RESULTS:

Demographic and basic data:

The patient group consisted of 21 patients with hyperthyroidism with a mean age of 39 ($\pm$ 12) years. Three patients were males (14.3%), and eighteen patients were females (85.7%). The reference group consisted of 21 healthy volunteers with a mean age of 34.6 ($\pm$ 6.6) years, including two males (9.5%) and 19 females (90.5%). Both groups were matched for age and gender. None of the subjects was a professional voice user (Table 1).

Table 1: Demographic characteristics of the studied groups:

	Patients group n=21	Reference group n=21	P-value
Age			
Mean (SD)	39.0 (12.01)	34.6 (6.6)	0.1
Gender Number (%)			
Male	3 (14.3)	2 (9.5)	1.00
Female	18 (85.7)	19 (90.5)	
Residence Number (%)			
Urban	7 (33.3)	12 (57.1)	0.3
Rural	14 (66.7)	9 (42.9)	

The most frequent manifestation of hyperthyroidism in the patient group was shortness of breath (62%), followed by fatigue and loss of weight (28.6% each). The disease duration ranged from 1 month to 9 years (median 12 months) (Table 2).

Table 2: Baseline symptoms among hyperthyroid patients

Variable	Studied Patients (n=21) Number (%)
#Clinical symptoms	
Shortness of breath	13 (62%)
Fatigue	6 (28.6%)
Loss of weight	6 (28.6%)
Exophthalmos	4 (19%)
Nervousness	2 (9.5%)
Disease duration in months	
Median	12.0
Min-max	(1.0-108.0)

Total number is not absolute

It was found that the median of T3, T4, and TSH levels in the hyperthyroid subgroup that did not receive medical treatment was 1.01 (0.4-1.4), 3.4 (1.4-34.0), 0.01 (0.005-0.05) ng/dl, respectively.

3.2. Subjective voice evaluation:

No dysphonia was detected in any of the patients enrolled in the study.

3.3. Objective voice evaluation:

Maximum Phonation Time and H/N ratio were reduced in hyperthyroid patients compared to the reference group with a statistically significant difference ($p < 0.05$). Shimmer was significantly higher in hyperthyroid patients than in the reference group ($p < 0.05$) (Figures 1 and 2). Pitch and jitter were also higher in hyperthyroid patients, but the difference was not statistically significant ($p > 0.05$) (Table 3).

Table 3: Comparison of aerodynamic and acoustic measures among studied groups:

	Patients group n=21	Reference group n=21	P-value
MPT			
Mean (SD)	10.8 (4.1)	13.8 (4.2)	0.02*
Median	10.0	14.0	
#Pitch			
Median	226.1	218.4	

(min-max)	(90.1-269.5)	(87.5-264.7)	0.1
Jitter			
Mean (SD)	0.37 (0.1)	0.33 (0.1)	0.4
Median	0.31	0.32	

VOICE EVALUATION IN HYPERTHYROIDISM

#Shimmer			
Median	2.37	1.65	0.002*
(min-max)	(1.2-10.7)	(0.87-5.06)	
H/ N ratio			
Mean (SD)	22.9 (4.2)	26.3 (3.1)	0.006*
Median	23.4	26.3	

MPT: maximum phonation time, SD: standard deviation, H/N: Harmonic /Noise Independent t-test, #Mann -Whitney test

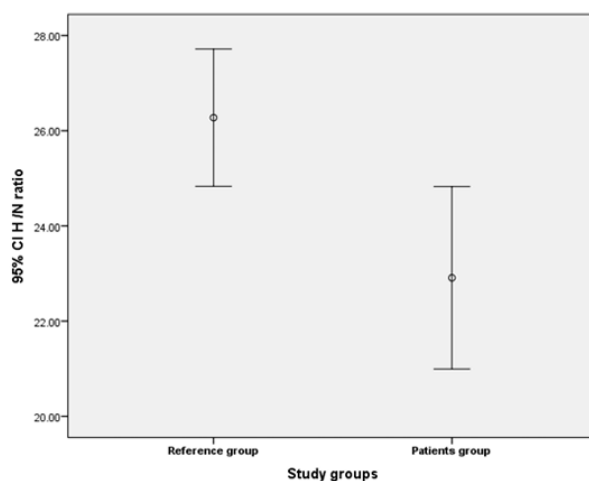


Fig. 1: Error bar chart for comparison of average harmonic noise (H/N) ratio among studied groups

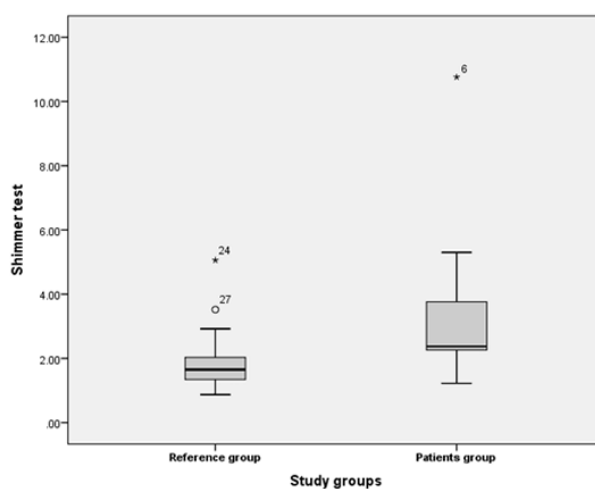


Fig. 2: Box-plot graph for comparison of shimmer among studied groups

When comparing the reference group with the two patient subgroups, none of the parameters showed a significant difference between patients receiving and patients not receiving medical antithyroid treatment. However, the shimmer, jitter, and

H/N ratio values were better in the subgroup receiving antithyroid therapy. On the other hand, both patient subgroups showed lower H/N ratio and higher shimmer values than the reference group with statistically significant differences ($p < 0.05$) (Table 4).

Table 4: Comparison of aerodynamic and acoustic measures among

	Patients receiving treatment (n=11)	Patients not under treatment (n=10)	Reference group (n=21)	<i>P-value</i>
MPT				
Mean (SD)	10.7 (4.02)	10.9 (4.4)	13.8 (4.2)	0.08
Median	10.0	11.0	14.0	
#Pitch				
Median	221.1	226.9	218.4	0.3
(min-max)	(140.0-269.5)	(90.1-262.7)	(87.5-264.7)	
Jitter				
Mean (SD)	0.31 (0.1)	0.43 (0.2)	0.33 (0.1)	0.2
Median	0.28	0.37	0.32	
#Shimmer				
Median	2.37 C	2.38 C	1.65	0.009*
(min-max)	(1.22-4.9)	(1.28-10.7)	(0.87-5.06)	
H/N ratio				
Mean (SD)	23.4 (3.2)C	22.4 (5.1)C	26.3 (3.1)	0.02*
Median	24.3	22.9	26.2	

MPT: maximum phonation time, SD: standard deviation, H/N: Harmonic /Noise
One way ANOVA, # Kruskal Wallis test

studied groups as regards treatment of hyperthyroidism:

DISCUSSION

Thyroid hormones are essential for the growth and development of many vital organs. The thyroid hormones affect humans' voices highly; this is interpreted by the presence of receptor alpha (TR- alpha) in the lamina propria, the glandular structures, and the thyroid cartilage, whereas TR-beta was existent only in the lamina propria[4]. This indicates the importance of thyroid hormones in voice production and laryngeal development.

Hyperthyroidism results in multi-system affection, which includes the larynx. Our study aimed at studying subjective and objective voice characteristics of patients with hyperthyroidism. Twenty-one patients with clinical hyperthyroidism and twenty-one healthy volunteers were subjected to voice assessment using subjective and objective means.

The female predominance in the patient group in our study was in agreement with previous studies by Bone et al.[12] and Costa and Pernambuco[13], as thyroid diseases are hormonal dependent and common in females with a 4:1 female to male ratio.

The objective voice assessment, particularly the acoustic analysis, has received considerable attention because of its low cost, easy applicability, and quantitative output[14]. According to de Felippe et al.[15], "the differences in the programming of the various acoustic analysis systems, as well as the use of recording criteria and computers, microphones, and other devices make each one of these systems a single one, thus, precluding a single normalization. Therefore, users should base themselves on their own normalization".

Jitter and shimmer are both parameters of acoustic analysis. They refer to frequency and amplitude variation, respectively, from cycle-to-cycle of sound waves[10]. Decreasing jitter and shimmer denotes better periodicity and symmetry in glottic wave vibration, which is reflected as a better subjective impression of voice.

The present results showed that the value of shimmer in the hyperthyroid group was significantly higher than that of the reference group. Similarly, jitter was higher in the hyperthyroid group, but the difference did not reach statistical significance. This might indicate that increasing the level of thyroid hormones has a potential effect on the vocal folds' frequency and amplitude of vibration.

H/N ratio is defined as the ratio between periodic and aperiodic components of a sound wave[16]. The periodic component arises from vocal fold vibration, whereas the aperiodic part follows from the glottal noise. Therefore high H/N ratio is associated with sonorant and harmonic voice.

Our results revealed that hyperthyroid cases had a lower H/N ratio than the reference group, with a statistically significant difference. This denotes that the voice of hyperthyroid cases is more liable to asthenia and dysphonia. As suggested by Kovacic[17], the general weakness and fatigue caused by hyperthyroidism reflect on laryngeal and respiratory musculature causing asthenic voice quality.

The non-significant difference between our patients and the reference group as regards fundamental frequency was contradictory to the result of Kovacic[17], who reported that female subjects diagnosed with hyperthyroidism demonstrated low fundamental frequency. The latter author stated that "deep voice is the most remarkable and should be added to clinical features of hyperthyroidism".

Maximum phonation time (MPT) is one of the aerodynamic measures considered a good functional indicator of glottal competence[18]. It usually ranges from 15-20 seconds for adults[19]. Our results showed a decrease in the mean value of MPT of hyperthyroid cases compared to the reference group with a statistically significant difference. This could be explained by respiratory muscle weakness with reduced subglottic pressure in patients with hyperthyroidism, as suggested by Junuzović-Žunić et al.[20].

Although the results of acoustic and aerodynamic assessments were not in favor of the hyperthyroid cases, none of them had dysphonia. This is attributed to the fact that the shimmer, jitter, H/N ratio, and MPT values did not reach the threshold of pathological voice. Nevertheless, these results make hyperthyroid patients more vulnerable to dysphonia than their euthyroid peers. Moreover, this denotes that increasing the levels of T3 and T4 may cause subclinical affection of phonatory functions of the larynx. Indeed, alteration of voice quality in patients with hyperthyroidism was reported in studies such as Youssef et al.[21]. Pfaff et al.[22] mentioned that voice problems are common presenting complaints in patients with thyroid disorders.

Even when treated preoperatively, hyperthyroidism is frequently associated with poor voice outcomes[22]. Muscle weakness, dehydration, tremors, as well as physiologic changes in laryngeal structure could contribute to voice changes in hyperthyroid patients[23]. As stated by Altman et al.[4], thyroid hormone receptors may play a role in the histologic and physiologic alterations in a voice that occur in thyroid dysfunction.

The present study results are in line with the results of the Kovacic[17] study, which indicated that acoustic voice characteristics and laryngeal efficiency in patients with hyperthyroidism fall outside normal ranges. However, contrary to the present results, Birkent et al.[24] assumed that the acoustic parameters could not detect subtle vocal fold changes. It is unlikely to identify any change without a significant vibratory or epithelial disease.

The present study revealed a non-significant difference between both patient subgroups when comparing the acoustic and aerodynamic results. However, the shimmer, jitter, and H/N ratio values were better in the subgroup receiving antithyroid therapy. The non-significant difference might be attributed to insufficient treatment duration. As stated by Hari Kumar et al.[1], voice changes caused by the thyroid gland disorders may disappear completely within 3-6 months after achieving euthyroidism.

Regardless of the limitation by the small sample size, this study indicates that the effect of hyperthyroidism on vocal function measures is an area of further research.

CONCLUSION

Despite the absence of perceptual voice changes in our patients with hyperthyroidism, subtle changes in the acoustic and aerodynamic parameters could be detected with a trend towards laryngeal dysfunction. This provides evidence that elevated levels of thyroid hormones potentially affect the phonatory function of the vocal folds. However, further studies need to be conducted with larger samples and with various objective voice measurements applied to better understand the laryngeal status in hyperthyroid patients.

CONFLICT OF INTEREST

There are no conflicts of interest.

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Endoscopic Transcanal Simple Myringoplasty Using Push Through Technique with Cartilage Ring Graft Versus Temporalis Fascia Graft

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ABSTRACT

Objective: Assessment of endoscopic transcanal simple myringoplasty using a push-through technique with cartilage ring graft versus temporalis fascia graft.

Patients and Methods: A prospective comparative study was conducted on 60 patients distributed randomly and equally into two groups. Both groups were subjected to endoscopic transcanal simple myringoplasty using a push-through technique with cartilage ring graft used in group I and temporalis fascia graft used in group II. The degree of improvement of postoperative air-bone gap (ABG) was assessed in both groups. Both groups were compared regarding healing, hearing success, and ABG gain. The correlation between the healing success and size and site of the perforation was assessed.

Results: The present study showed a highly significant ABG improvement in both groups ($p < 0.00001$ for both). There was a non-significant difference between the two groups regarding healing success (83.3% and 80% respectively), hearing success, and ABG gain ($p = 0.739, 0.417$, and 0.757 respectively). There was a non-significant correlation between the healing success in both groups and the perforation size ($p = 0.6221$ and 0.3598 , respectively). There was a non-significant correlation between the healing success of the operation in both groups and the perforation site ($p = 0.704$ and 0.516 , respectively).

Conclusion: Both cartilage ring and temporalis fascia grafts resulted in a highly significant postoperative improvement of ABG with comparable results regarding healing and hearing success and ABG gain. Both graft types showed a nonsignificant correlation between success and site and size of the perforation.

Key Words: Cartilage ring, endoscopic, myringoplasty, push through, temporalis fascia.

INTRODUCTION

Although Microscopic myringoplasty remains the standard approach for tympanic membrane perforation repair, it has some limitations regarding visualization of the surgical field in some cases like prominent anterior canal wall and anterior quadrant or marginal perforations[1,2]. These limitations raise the need for invasive procedures like canaloplasty or the postauricular approach[2]. On the other hand, transcanal endoscopic ear surgery (TEES) has emerged since the 1990s, first as an adjunct to an operating microscope then as an exclusive tool for different otologic surgeries[3-7]. Endoscopy offered a broader surgical view overcoming the previously mentioned limitations of the microscopic approach like postauricular incision and canaloplasty. It also allowed visualization of some hidden areas of the middle ear cleft with less interference by the external auditory canal curvature[8-10]. Different graft materials, including composite cartilage perichondrial and temporalis fascia grafts, are available for tympanic membrane perforation repair using various preparation and placement techniques. This study aimed to compare endoscopic transcanal simple myringoplasty using a push-through technique with cartilage ring graft versus temporalis fascia graft.

PATIENTS AND METHODS:

The current study was a prospective comparative study comparing two graft materials for endoscopic transcanal repair of small and medium-sized tympanic membrane perforation using a push-through technique. Patients of the study were recruited from the Otorhinolaryngology Department, Menoufia University Hospital during the period from January 2019 to July 2020 after approval of the hospital's ethical committee. Informed written consent was taken from every patient before participation in the study.

To be included in the study, patients aged between 18 and 70 years old with an absence of otorrhea at least for three months and lack of inflammation or infection in middle-ear mucosa and mastoid air cells. Patients should have small to medium-sized dry central perforation. Patients with other ear pathologies like cholesteatoma or ossicular disruption, and patients with surgical unfitness like bleeding tendency and uncontrolled systemic diseases were excluded from the study.

All patients were assessed preoperatively by history taking and complete ENT examination. Otoscopic and microscopic examination of the ear was performed for every patient to confirm the site and size of the perforation and state of middle ear mucosa. The perforation site was either small (occupying less than a quadrant of the tympanic membrane) or medium (occupying less than two quadrants of the tympanic membrane). The perforation site was either central, predominantly anterior, or predominantly posterior. Audiological evaluation by pure tone audiometry was done to assess the type and degree of hearing loss with air-bone gap (ABG) measurement. Routine preoperative investigations were done for every patient, including complete blood picture, hepatic, renal, bleeding, and coagulation profiles.

Sixty patients were included in the study and were randomly and equally divided into two equal groups by block randomization method using 30 blocks of two. Each block has 2 patterns, one of them was selected randomly using a computer excel program. Both groups were operated under general anesthesia with endotracheal intubation and subjected to endoscopic transcanal simple myringoplasty using a push-through technique. The grafting material was a cartilage ring in group I and temporalis fascia in group II.

Graft harvesting and preparation:

The cartilage-perichondrium graft in group I was harvested from tragal cartilage. The tragus was injected with 2% lignocaine (to minimize postoperative pain) and 1:100,000 adrenalin drug (to minimize bleeding). An incision was made along the free edge of the tragus, and the subcutaneous tissue was dissected to the lateral border of the cartilage and its perichondrium. The cartilage was then harvested with its attached perichondrium, with the donor site closed using non-absorbable sutures. The perichondrium was left attached to the concave side of the cartilage (Figure 1-A). The graft was approximately 12–15 mm in diameter. A circular piece of cartilage was cut from the center of the cartilage on the convex side using a number 15 scalpel blade or the sharp edge of an ear speculum. The cut circular piece of cartilage was removed with gentle dissection, avoiding laceration of the attached perichondrial sheet. This technique yielded a perichondrial sheet with an attached peripheral cartilage ring (Figure 1-B). According to the periphery needed, the cartilage ring was trimmed, preserving a good rim of a firm, elastic, and intact cartilage (2–3 mm) with the graft's size a little larger than the membrane tensa size. The temporalis fascia graft in group II was harvested through a 2 cm postaural incision in the

temporal region of the scalp after infiltrating with 2% lignocaine (to minimize postoperative pain) and 1:100,000 adrenalin drug (to minimize bleeding). The graft is then dried under a heating lamp (Figure 2) and trimmed to fit the perforation size. The incision for graft harvesting was closed using non-absorbable sutures.

Surgical technique:

Telescopes of 0 and 30 degrees with diameters of 2.7 and 4 mm were used for the endoscopic approach. The perforation margin and anterior annulus were visualized through endoscopy. The perforation margin was circumferentially freshened using a pick or a sickle knife. In group I, cartilage ring graft was pushed through the perforation and placed in an underlay manner medial to the tympanic membrane remnant with the cartilage ring resting in the tympanic sulcus and facing medially and perichondrium facing laterally, leaving the cartilage ring resting in the tympanic annulus and on the medial wall of the middle ear without the need for gel foam packing of the middle ear. In group II, the middle ear cavity was tightly packed with an absorbable gelatin sponge (Pfizer Inc, NY, US) through the perforation. The tubal orifice was plugged with gel foam to prevent the graft's medialization because of negative pressure produced by sniffing. Then the temporalis fascia graft was pushed through the perforation and placed in an underlay manner medial to the tympanic membrane remnant. Absorbable gelatin sponge pledgets soaked with antibiotic drops were placed lateral to the graft in the external auditory canal.

Postoperative care:

The patients were discharged the next morning on a 10-day course of oral amoxicillin-clavulanic acid. At the end of the 10th postoperative day, the Gelfoam was sucked from the external ear canal to avoid a granulomatous reaction. Three weeks later, the patients were encouraged to start doing gentle Valsalva maneuvers. The patients were followed for three months with pure tone audiometry performed for every patient at the end of the follow-up period.

Outcomes:

Successful graft acceptance was defined as full, intact healing of the tympanic membrane without perforation. Assessment of hearing improvement was based on the audiogram performed at three months postoperative. The ABG closure to within 20 dB was considered as hearing success. ABG gain was defined as the difference between the pre and postoperative ABGs. Results were analyzed by comparing pre and postoperative ABGs in both groups. Both groups were compared regarding healing and hearing success and ABG gain. The healing success of both groups was correlated with the size and site of the perforation

Statistical Analysis:

Data were collected, tabulated, and statistically analyzed using an IBM personal computer with Statistical Package of Social Science (SPSS) version 22, IBM Corp, Armonk, NY, USA. Descriptive statistics for quantitative data were presented as mean ($\bar{X}$) and standard deviation (SD). Qualitative data were presented as numbers (No.) and percentages (%). Data turned up to be non-normally distributed according to the Kolmogorov-Smirnov test. Mann-Whitney U test was used to compare quantitative data of both groups. Chi-squared (χ^2) and Fisher Exact tests were used to study the

relationship between two qualitative variables. Wilcoxon signed-rank test was used to compare preoperative and postoperative quantitative data of each group. A two-sided p-value of (<0.05) was considered statistically significant while a p-value of less than 0.001 was considered statistically highly significant.

RESULTS:

The current study included 60 patients distributed equally as two groups subjected to endoscopic transcanal simple myringoplasty using a push-through technique with cartilage ring graft in group I and temporalis fascia graft in group II. Group I included 19 (63.3%) males and 11 (36.7%) females with a mean age of 29.7 ± 9.88 SD years. Group II included 16 (53.3%) males and 14 (46.7%) females with a mean age of 30.3 ± 10.26 SD years. There was a non-significant difference between the two study groups regarding age, sex, size, and site of the perforation and preoperative air-bone gap (0.912, 0.432, 0.196, 0.548, and 0.992, respectively) (Table 1).

The present study showed a highly significant improvement in the air-bone gap in both groups ($p < 0.00001$ for both) (Table 2). There was a nonsignificant difference between the two groups regarding healing success (83.3% and 80%, respectively), hearing success, and ABG gain ($p = 0.739$, 0.417, and 0.757) (Table 3)

In the current study, there was a non-significant correlation between the healing success in both groups and the perforation size ($p = 0.622$ and 0.36, respectively) (Table 4). There was a non-significant correlation between the healing success in both groups and the perforation site ($p = 0.704$ and 0.516, respectively) (Table 5).

Table 1: Demographic and clinical data of both study groups.

Item		Group I (30)		Group II (30)		Statistical Test	<i>P value</i>
		No	%	No	%	Chi square test	
Gender	Male	19	63.3	16	53.3	0.6171.	0.432
	Female	11	36.7	14	46.7		
Size of perforation	Small	12	40	17	56.7	1.6685	0.196.
	Medium	18	60	13	43.3		
Site of perforation	Mainly anterior	12	40	10	33.3	1.204	0.548
	Mainly posterior	8	26.7	12	40		
	Central	10	33.3	8	26.7		
		Mean $\pm$ SD		Mean $\pm$ SD		Mann Whitney U test	
Age		29.7 $\pm$ 9.88		30.3 $\pm$ 10.26		Z= -0.111	0.912
Preoperative ABG		27.17 $\pm$ 4.68		29.33 $\pm$ 4.3		Z = 0.007	0.992

Table 2: Comparison between preoperative and postoperative air bone gap in both study groups:

Group	Preoperative ABG Mean $\pm$ SD	Postoperative ABG Mean $\pm$ SD	Wilcoxon signed rank test	<i>P value</i>
Group I	27.17 $\pm$ 4.68	16.5 $\pm$ 4.76	Z = 5.70679	< 0.00001
Group II	29.33 $\pm$ 4.30	17.83 $\pm$ 5.68	Z= 5.61069	< 0.00001

Table 3: Comparison between study groups regarding postoperative outcomes:

Parameter		Group I		Group II		Statistical Test	<i>P value</i>
		No	%	No	%	Chi square test	
Healing success	+ve	25	83.3	24	80	0.1113	0.739
	-ve	5	16.7	6	20		
Hearing success	+ve	21	70	18	60	0.6593	0.417
	-ve	9	30	12	40		
ABG gain		Mean ± SD		Mean ± SD		Mann Whitney U test	
		11.33333333		10.83333333		0.31047.	0.757
		4.535935697		5.099583035			

Table 4: Correlation between the success of the operation and size of the perforation

Group	Size of perforation	Completely healed	Partially healed	Fisher Exact Test P value
Group I	Small	11	1	0.6221
	Medium	14	4	
Group II	Small	15	2	0.3598
	Medium	9	4	

Table 5: Correlation between the success of the operation and site of the perforation

Group	Size of perforation	Completely healed	Partially healed	Fisher Exact Test P value
Group I	Mainly anterior (12)	9	3	0.704
	Mainly posterior (8)	7	1	
	Central (10)	9	1	
Group II	Mainly anterior (10)	7	3	0.516
	Mainly posterior (12)	11	1	
	Central (8)	6	2	

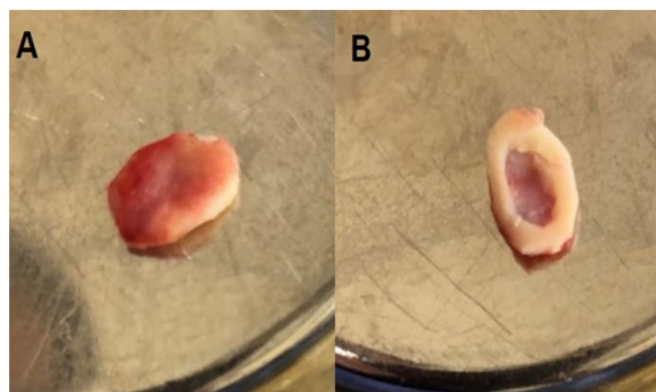
**Fig. 1:** Cartilage ring graft: A: Perichondrial side, B: Cartilaginous ring side



Fig. 2: Temporalis fascia graft

DISCUSSION

Endoscopic type I tympanoplasty was initially introduced in the 1990s, and the extensive spread of this practice can be easily observed over the last years with variable techniques and graft materials. In the current study, we adopted the endoscopic approach to repair small and medium-sized tympanic membrane perforation. Several studies have compared endoscopic and microscopic tympanoplasty. A meta-analysis conducted by Tseng et al.[12] reported comparable tympanic membrane closure rates and hearing results for endoscopic and microscopic tympanoplasty. Patients receiving endoscopic tympanoplasty had a lower canaloplasty rate and more favorable cosmetic results than those receiving microscopic tympanoplasty. Another meta-analysis conducted by Pap et al.[11] showed that the surgical outcomes of endoscopic type I tympanoplasty in terms of graft healing, postoperative hearing, and operative duration were comparable to microscopic type I tympanoplasty. Regarding cosmetic results, the endoscopic group had more desirable results, mainly due to a significantly lower incidence of canaloplasty. Similarly, Manna et al.[13], in a metaanalysis of outcomes following tympanoplasty and stapes surgery using endoscopic versus microscopic approach, reported that audiological, functional, and complications outcomes were similar, if not superior, for the endoscopic approach to both tympanoplasty and stapes surgery compared to the microscopic approach. Tympanoplasty patients undergoing the endoscopic approach had lower canaloplasty rates, better cosmetic outcomes, and shorter operative durations. This metaanalysis supported the use of endoscopic techniques for tympanoplasty and stapes surgery.

In the current study, we used the push-through technique without raising tympanomeatal flap. Several studies have compared the push-through technique with the traditional tympanomeatal elevation technique. El-Hennawi et al.[14] evaluated 56 patients with small anterior tympanic membrane perforations. Perforations were repaired with an endoscopic pushthrough technique ($n = 28$) or a microscopic underlay technique ($n = 28$). They found that the endoscopic push-through technique for anterior tympanic membrane perforations was as effective as microscopic underlay myringoplasty, with being less invasive and having less operative duration. Erden and Gülşen[15] evaluated surgical and audiological outcomes of pushthrough myringoplasty and microscopic underlay cartilage

tympaanoplasty in repairing anterior tympanic membrane perforations. They found that push-through myringoplasty yielded shorter operative duration and fewer postoperative complications and morbidity and may serve as an efficient alternative to conventional microscopic underlay technique in treating anterior tympanic membrane perforations, with comparable graft healing rates and audiological outcomes. Lou[16] assessed 93 pediatric patients with perforation who underwent myringoplasty. Patients were randomized between cartilage push-through and underlay fascia grafts. They found that endoscopic cartilage pushthrough and underlay fascia graft myringoplasty had comparable hearing results in pediatric patients; However, they found that the push-through technique without the elevation of a tympanomeatal flap exhibited better long-term graft success rate compared to underlay fascia graft.

In the current study, we compared two graft materials: temporalis fascia and cartilage ring grafts. The temporalis fascia graft has been considered as a standard graft material for many otologists; however, the use of cartilage tympanoplasty has been evolving over the past years. Several studies have compared cartilage and fascia tympanoplasty with several studies comparing their healing and hearing results. Mohammad et al.[17], in their systematic review, found that tympanoplasty using cartilage with or without perichondrium had a better morphological outcome than tympanoplasty using temporalis fascia. However, there was no statistically significant difference in hearing outcomes between the two grafts. In their meta-analysis, Yang et al.[18] found that tympanoplasty using cartilage grafts had a better graft healing than using temporalis fascia grafts. There were no significant differences between cartilage grafts and temporalis fascia grafts for hearing outcomes. Contrary to the sliced cartilage subgroup, full-thickness cartilage grafts generated better hearing outcomes than temporalis fascia grafts. Jalali et al.[19] conducted a meta-analysis and found that cartilage grafting seemed to show a higher graft integration rate than temporalis fascia grafting. Both cartilage and fascia tympanoplasty provided similar improvements in the hearing outcome postoperatively.

In the current study, we found a comparable healing success rate between cartilage ring and temporalis fascia grafts (83.3% and 80%, respectively) with a non-significant difference regarding hearing success or ABG gain. Both graft materials showed a highly significant postoperative improvement of ABG with no significant correlation between the healing success at one hand and the size or site of the perforation on the other hand. Some studies have evaluated the cartilage ring grafts for the repair of tympanic membrane perforation. Debasish et al.[20] proposed using a composite graft of tragal perichondrium supported by a ring of cartilage peripherally for the closure of big central and subtotal perforation by tympanoplasty using underlay technique. They found an overall graft take rate of 93.33%. Albirmawy[21] evaluated the anatomical and audiological outcomes of primary type one tympanoplasty performed with a composite cartilage-perichondrium 'ring' graft. He compared these outcomes with the outcomes of temporalis fascia graft in children. He found that cartilage-perichondrium composite ring graft yielded good anatomical and functional results. The anatomical results obtained using this graft were superior to those for temporalis fascia. The ring graft group had equivalent, if not better, postoperative audiometric results than the temporalis fascia group.

Albirmawy[21] attributed the better surgical outcomes of cartilage ring graft to the fact that the presence of a firm yet malleable peripheral cartilaginous ring fits and stabilizes the graft within the tympanic bony annulus under the tympanic membrane fibrous annulus. This stabilization makes the graft resistant to the retraction by negative middle ear pressure, lateralization, with no blunting. The lack of a large central cartilaginous disc enables the stretched perichondrium to be freely mobile with better compliance. This graft design gave morphological and audiological outcomes similar to the natural

tympanic membrane. The limitations of this study included a relatively small sample size. All the cases meeting the inclusion criteria at the otorhinolaryngology outpatient clinic during the study period were included in the study without a preliminary sample size assessment. Another limitation was the short follow up periods of three months. Larger studies with longer follow-up periods are required for better assessment of the anatomical and functional outcomes at a long term scale.

CONCLUSION

The endoscopic transcanal approach with push-through technique is an effective approach for repairing small and medium-sized tympanic membrane perforations. Both cartilage ring and temporalis fascia grafts showed comparable results regarding healing and hearing success and air-bone gap gain with a non-significant correlation between success and site and size of the perforation. Cartilage ring grafts offer a good grafting material that should be considered for endoscopic repair of tympanic membrane perforation.

CONFLICT OF INTEREST

There are no conflicts of interest.

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Assessment and Surgical Correction of The Long Nose

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ABSTRACT

Introduction: The long nose represents one of the most undesirable features in facial aesthetics leading to facial

disharmony. Despite being a common feature, review of the surgical literature shows that little attention has been given to analyze and manage the long nose.

Aim: Identify the causes of long nose in the Egyptian population and proposed a surgical algorithm for correction of the long nose deformity.

Patients and Methods: Fifty patients with long nose deformity were recruited in this study. Assessment to identify cause of long nose in addition to pre-operative measurements of nasal length, projection, nasolabial and nasofrontal angles were recorded and compared with the postoperative measurements after correction with the proposed algorithm.

Results: Multifactorial causes contribute to the long nose deformity. Most common cause in our study is lack of nasal tip support in 94% of the cases, this was due to either long weak inferiorly oriented lower lateral cartilages in 35 patients or short weak medial crura in 12 patients. 76% of the cases had an under-projected tip in association with the long nose deformity. Our proposed surgical algorithm shows highly significant statistical difference between the pre-operative and post-operative nasal length as well as nasal tip projection.

Conclusion: Multiple factors contribute to the long nose deformity. Egyptians most commonly have a long nose with under-projected tip due to lack of nasal tip support. Following a Surgical algorithm in rhinoplasty is helpful stepwise approach to plan for surgery however each operation must be tailored accordingly to each patient.

Key Words: Droopy tip, long nose, rhinoplasty.

INTRODUCTION

Rhinoplasty is considered one of the most complex cosmetic surgical procedures performed today, since it is characterized by an intricate interplay between form and function. The prerequisite for successful execution of this challenging procedure is a thorough understanding of the nasal anatomy and physiology[1]. Moreover, comprehensive clinical analysis and definition of goals, preoperative preparation, precise operative execution, postoperative management, and critical analysis of one's results are considered essential principles for successful rhinoplasty[2].

The long nose represents one of the most undesirable features in facial aesthetics that may lead to disturbance in the harmony of the face. Despite being a common feature, review of the surgical literature shows that little attention has been given to analyze, evaluate and manage the long nose[3]. With this in mind, we looked to investigate the different causes that contribute to the long nose in the Egyptian population and formulate a treatment algorithm for correction.

PATIENTS AND METHODS:

Fifty patients were recruited in our study which was conducted in Ain Shams University Hospitals in the time period between February 2017 to October 2019. All participants signed an informed consent after explaining to them the objective of the study. The selected patients underwent thorough history and examination to diagnose the underlying deformity. This was followed by preoperative photographs which included frontal, lateral, oblique and basal views. The preoperative lateral view photographs were used to record the nasofrontal angle, nasolabial angle, tip projection in relation to nasal length using Goode's method and nasal length in relation to midfacial height (Fig 1). These measurements were taken using the software Adobe® Photoshop® CS6. We used these data to study the causes of long nose in the Egyptian population. In addition to the above measurements we also assessed the degree of skin thickness in our cohort of patients.

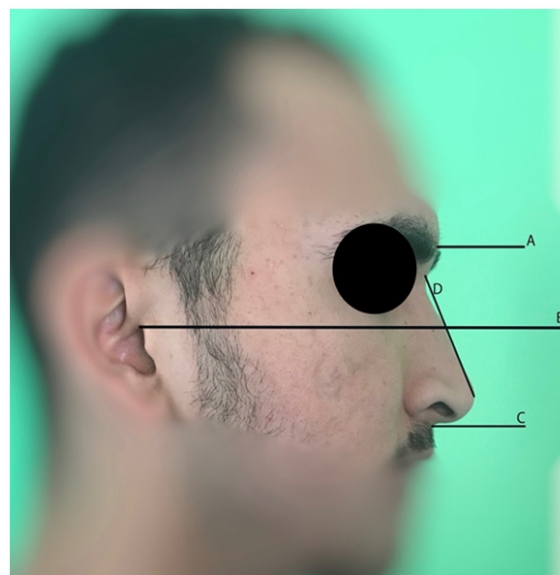
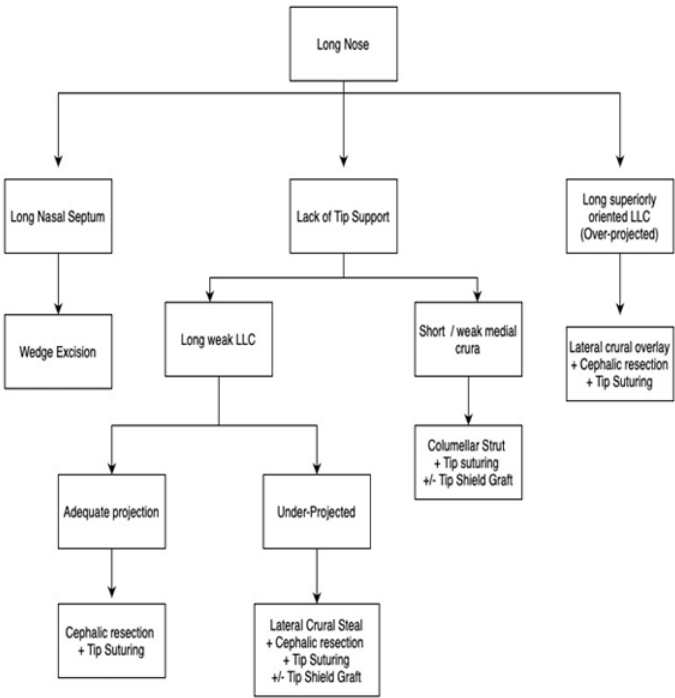


Fig 1 A: line from Glabella parallel to Frankfort horizontal plane. B: Frankfort horizontal plane. C: Line from Subnasale parallel to Frankfort horizontal plane. D: Nasal length from radix to tip defining points. According to Byrd, ideal nasal length is D would be $\frac{2}{3}$ line from A to C (Mid facial height).

Patients then underwent open septorhinoplasty approach under general anesthesia after written consent. The septorhinoplasty procedure was planned and performed following our suggested treatment algorithm (Fig 2) Patients were assessed for follow up at one, three, six and twelve months postoperatively. At one year postoperative, measurements were recorded of the same angles and dimensions and were then compared to our preoperative measurements for analysis.



In cases of overactive depressor nasi muscle : Cutting of its fibres from its attachment

Fig 2: Our proposed surgical correction algorithm for long noses

RESULTS:

Our study group constituted of 28 male patients and 22 female patients. Mean age was 37.6 years. Most cases had more the one contributing factor to the long nose deformity. The most common contributing factor to the long nose deformity was poor nasal tip support in 94% of the cases. This was either due to long weak inferiorly oriented LLC in 35 patients or due to short weak medial crura in 12 patients. This is followed by long nasal septum which was the case in 45 patients (Table 1).

These contributing factors results in variable degrees of nasal projection, most commonly under-projected droopy tip in 76% of the cases (Table 2). As a result, we did a sub-analysis dividing our cohort of patients into 3 categories according to their nasal projection.

Table 1: Patient Demographics and Factors contributing to long nose deformity among study group

		No			%
Gender	Male	28			56.0%
	Female	22			44.0%
Factors contributing to Long Nose deformity	Lack of nasal tip support	47			94%
	Long weak inferiorly oriented LLC*	35*	12**	70%*	24%**
	Short weak medial crura**				
	Long Nasal Septum	45			90%
	Long Superiorly oriented LLC	2			4%
	Overactive depressor nasi	2			4%
	High Radix	1			2%

Table 2: Nasal Projection among study group

	No	%
Under-projected Nose	38	76%
Adequately Projected Nose	10	20%
Over-projected Nose	2	4%

Table 3: Comparison between pre and postoperative nasal measurements among under-projected study cases (38/50)

Pre-operative Nasal Length	0.76	0.03	0.001	HS
Post-operative Nasal Length	0.69	0.02		
Pre-operative Nasofrontal angle	142.13	9.30	0.009	HS
Post-operative Nasofrontal angle	138.05	6.69		
Pre-operative Nasolabial angle	81.05	7.52	0.001	HS
Post-operative Nasolabial angle	99.56	4.78		
Pre-operative Tip projection	0.50	0.02	0.001	HS
Post-operative Tip projection	0.57	0.02		

*Paired t test

Data analysis of the under projected subgroup after correcting the underlying deformity as per our proposed algorithm shows highly significant difference between the pre and post-operative measurements in nasal length bring it closer to the ideal ratio of being 2/3 midfacial height. It also shows highly significant difference in the nasolabial angle and tip projection bringing these measurements and angles closer to the ideal ratios.

Table 4: Comparison between pre and post-operative nasal measurements among cases with normal projection (10/50 patients)

	Mean	±SD	P	Sig
Pre-operative Nasal Length	0.75	0.04	0.001	HS
Post-operative Nasal Length	0.69	0.03		
Pre-operative Nasofrontal angle	137.53	8.36	0.007	HS
Post-operative Nasofrontal angle	135.06	8.63		
Pre-operative Nasolabial angle	93.49	10.09	0.001	HS
Post-operative Nasolabial angle	103.61	8.61		
Pre-operative Tip projection	0.58	0.08	0.971	NS
Post-operative Tip projection	0.58	0.03		

*Paired t test

Data analysis of the cases with adequate projection after correcting the underlying deformity with our suggested algorithm shows highly significant difference in the pre and post-operative measurements of the nasal length. It also shows improvement in the nasolabial angles. We have also managed to keep the nasal projection within the ideal ratio of 0.55-0.60 as per Goode's ratio.

Table 5: Comparison between pre and postoperative nasal measurements among over-projected cases (2/50 patients)

	Mean	±SD
Pre-operative Nasal Length	0.74	0.02
Post-operative Nasal Length	0.68	0.02
Pre-operative Nasofrontal angle	157.5	2.5
Post-operative Nasofrontal angle	135.3	3.1
Pre-operative Nasolabial angle	83.4	2.4
Post-operative Nasolabial angle	103.15	8.15
Pre-operative Tip projection	0.66	0.04
Post-operative Tip projection	0.58	0.02

Analysis of our patients with over-projected nose was difficult to obtain statistical significance as they were only two patients. However, our algorithm of correction has resulted in reduction of the nasal length and projection as well as increased rotation of the nasolabial angle and reduction of the nasofrontal angle establishing more aesthetic measurements.

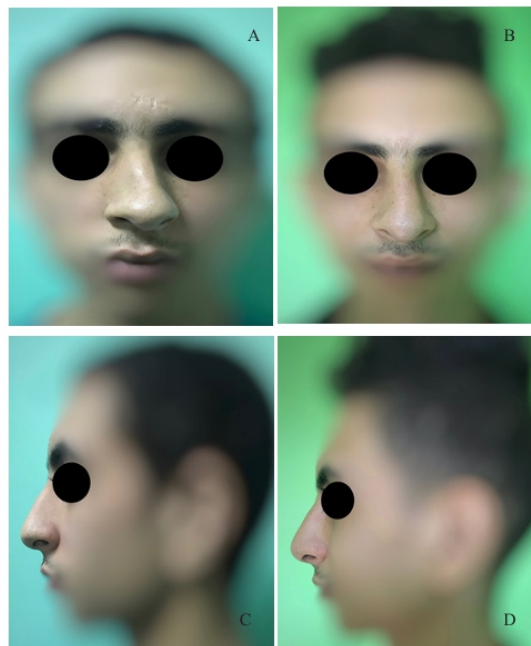


Fig. 3: A, C preoperative photographs for a patient with long nose with an associated crooked nose. This was due to long nasal septum and long lower lateral cartilages B, D Postoperative photographs after correction with the proposed surgical algorithm.



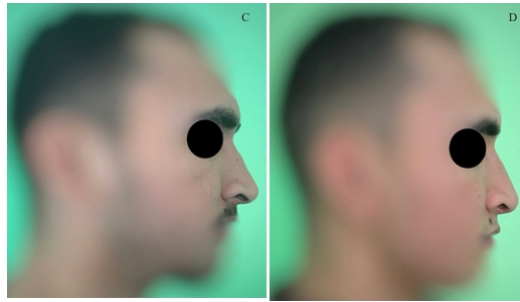


Fig. 4: A, C preoperative photographs for a patient with long nose and poor tip support due to long lower lateral cartilage and short and weak medial crura. B, D Postoperative photographs after correction with the proposed surgical algorithm



Fig. 5: A, C preoperative photographs for a patient with long nose with adequate projection nose and an associated crooked nose due to long nasal septum. B&D Postoperative photographs after correction with the proposed surgical algorithm.



Fig. 6: A, C preoperative photographs for a patient with long nose with an associated crooked nose and droopy nasal tip due to long septum and poor tip support due to long weak LLC and weak medial crura. B, D Postoperative photographs after correction with the proposed surgical algorithm.

DISCUSSION

The Long nose deformity is one of the most complex nasal deformities to correct. This comes from the fact that it often involves more than one factor or cause. Therefore, requiring accurate and precise determining of the cause, as well as planning for correction

Accurate understanding of the nasal angles, projection and rotation particularly around the nasal tip is paramount and understanding the impact of the surgical techniques on these angles postoperatively is the key to successful surgery. This was the driving challenge of the authors to propose this structural algorithm for the management of Long nose.

In our series, we have identified that almost all cases multiple causes that contributed to the long nose rather than one single factor, which makes dealing with such deformity challenging and complex requiring a targeted tailored approach to each case.

As we assessed the causes of the long nose in Egyptian population, we have identified the most common factor to be the lack of nasal tip support (94%). This could be further classified to long, weak inferiorly oriented lower lateral cartilages (70%) or short and/or weak medial crura (24%) both of which will mostly result in a droopy under-projected nose (76%) or in some cases adequate projection (20%) with an acute nasolabial angle. The second most common cause long nasal septum (90%) which co-existed with other deformities of the lower lateral cartilages. Next came the long lower lateral cartilages that were superiorly oriented resulting in an over projected nose in 4% of the cases. One of our patients had a high radix further contributing to his long nose appearance. Finally we identified[2] cases in our cohort of patients with an overactive depressor nasi muscle resulting in smiling deformity along with their long nose appearance (Table. 1). We have also identified among our study group that the majority had an under-projected nose with 76% of the cases (Table. 2)

Our first step in the correction of the long nose deformity is to address the nasal septum since it contributed to the deformity whether solely or with other factors in 90% of our cases. As highlighted by Guyron[5], various geometric excisions of caudal septum will affect the nose differently. Excision in rectangular fashion will result in shortening of the entire nasal length. In cases of droopy tip where cephalic rotation is required, then wedge excision with the base of the wedge superiorly will in turn change the position of the anterior septal angle leading to increased tip rotation. Other techniques to shorten the septum include high septal step incisions, which is described by Aygit et al[4], where the septal cartilage excisions were performed at different levels to increase the rotation and projection

After correcting the nasal septum we addressed the nasal tip support mechanisms. In cases with long weak inferiorly oriented LLC resulting in under-projection we corrected this with combination of cephalic resection of LLC, tip suturing and Lateral crural steal technique to increase tip rotation and projection. On the other hand, the cases with long LLC but with adequate projection (20%) had a long nasal septum as a coexisting factor contributing to the long nose deformity therefore we performed cephalic resection of LLC and tip suturing along with the septal excisions.

Whereas cases with weak and or short medial crura, resulting in droopy under-projected, nose this was corrected with the use of columellar strut. Depending on skin thickness to further increase projection and obtain a well defined tip we additionally used tip shield graft in all cases with thick skin (11 cases) and some cases that had intermediate skin thickness (7 out of 37 cases).

In cases with long LLC with superior orientation resulting in an over- projected nose (4%) we advocate the use of the lateral crural overlay technique, with the aim to deproject the nose. Of note, the lateral crural overlay technique is a powerful technique to deproject the nose so it must be done carefully to avoid overcorrection which can be then be difficult and tricky to fix.

Adjunctive maneuvers used for further tip definition such cephalic trim of LLC, suturing techniques which included transdomal, interdomal and septocolumellar sutures as well the use of columellar struts. The Septocolumellar suture is often overlooked especially by junior rhinoplasty surgeons, but in our experience, we find it is an important and additional useful technique particularly in under-rotated noses to increase tip rotation. The septocolumellar suture also slightly increases the tip projection, however we believe that it should not be used as a replacement for a columellar strut, if required, but we consider it more of an additional suture technique that helps fine tune the tip position with respect to the caudal septum.

Finally, the importance of dynamic forces should not be overlooked, as we assessed patients with smiling deformity, where an overactive depressor nasi muscle, pulling the nasal tip downwards, would have to be addressed intraoperatively. This was achieved by dividing and cutting of the muscle fibers from its attachments.

Our proposed algorithm proved high statistical significance between the pre and post operative measurements in the under-projected and adequately projected noses, we could not perform full statistical analysis in the long noses with over-projected subgroup due to the small number of patients in our study. However our post op measurements of nasal length, projection, nasolabial and nasofrontal angles in all the long nose subcategories with different nasal projections are all within or closer to the ideal aesthetic measurements.

On reviewing the literature and published studies, Aygit[4] and his colleagues in 2006 published their experience on management of long noses. Their approach was different in classifying the long nose in those with long septum and another category with dislocated alar complex. They focused their correction on septal incision techniques to modify the anterior septal angle hence modifying tip rotation and projection. Patients with dislocated alar complex, they used tongue in groove technique, septal extension grafts and columellar struts according to the deformity.

In another study by Farag and his colleagues in 2011[3], they present a multicenter case series of long noses in 3 Middle Eastern countries. They used the radix to tip distance and the radix to columellar base distance in their analysis of the nasal length. We feel that the analysis of the nasal length in relation to the midfacial height is more representative and considers the whole facial symmetry. Their study shows similar findings in the analysis that the patients with long noses are often due to multiple factors.

Another key paper in 2009 where Sajjadian and Guyuron[6] presented their experience in management of long noses. In their review article, they classify long droopy noses into two main categories. Those

with true long noses with tip ptosis and another category with an apparent long nose due to subnasale retraction. They subdivided the group with long ptotic tip into long septum, long lower lateral cartilage and short medial crura. They describe similar techniques to correct long septum using wedge excision and tongue in groove. For correction of elongated lower lateral cartilages, they have used a combination of columella strut, onlay graft and tip rotation sutures for underprojected tip, whereas they used lateral crural overlay for overprojected tips. In cases of short medial crura they used columellar strut or medial crura anchor sutures.

Another study from Korea in 2013[7], focusing on long nose in East Asians has classified long noses into static and dynamic causes. Static causes being long nasal septum, long lower lateral cartilages and weak aponeurotic attachments to anterior septal angle. Dynamic causes included the forces of muscles influencing the nasal tip. In addition to depressor septi muscle, they highlight the influence of levator labii superioris alaeque nasi muscle as it pulls the alar base to cephalic direction on the nasal wing leading to a droopy tip.

Their corrective surgical algorithm is mainly dependent on lateral crural steal suture, with columellar strut, tip grafts and excision of depressor septi muscle. In special circumstances, they considered additional techniques such as caudal septal excision, lateral crural overlay in overprojected nose. They also described the use of silicone implants to augment in the anterior nasal spine as well as debulking of subcutaneous fat tissue and redundant skin excision. However, both latter techniques we have strong reservations on as we would not advocate skin excision in rhinoplasty, and debulking of subcutaneous fat tissue should be done very carefully as this potentially could compromise the vascularity of the soft tissue envelope leading to catastrophic complications. We have no experience over the use of synthetic implants and again we strongly advocate against their use given the wellknown and documented high infection and extrusions rates as reported in literature. Instead in cases with thick skin we recommend the use of cartilaginous tip shield grafts for further tip projection and definition.

To our knowledge, this is the first study to address the long nose in a systematic manner to come up with a surgical algorithm supported by pre and postoperative measurements and results. Hossam Fouda[8], in 2003, published a large series of 500 patients for management of droopy tip, comparing three alar cartilage modifying techniques and their effect on the tip projection and rotation. Our study results correlates with Fouda, that most cases it is more than one factor contributing to the droopy tip.

Similarly our results also conclude that the lateral crural steal is the best for correcting an underprojected droopy tip, whereas the lateral crural onlay technique is best for the overprojected tip. We differ from Fouda, as he primarily used the tongue in groove technique for droopy tips with normal projection. However, we believe that similar results could be achieved with cephalic LL resection and suturing techniques, and in cases of long nose, wedge excision of septum and altering of the anterior septal angle delivers similar results, avoiding the unpleasant sequel of rigid tip that patients complain of following the tongue in groove technique.

We also differ from Fouda's study as we investigated the role of the long septum in contributing to the long nose and droopy nasal tips with suggested techniques in our algorithm to correct this as highlighted previously. We also differ in assessing the skin thickness and advocating the use of tip grafts to increase tip projection and definition in all cases with thick skin and selected cases with intermediate thickness skin.

CONCLUSION

Careful preoperative analysis is a crucial step in rhinoplasty, and the use of facial analysis software is a valuable adjunctive tool. In our assessment of the long nose in the Egyptian population the most common contributing factor is poor tip support either due to long weak inferiorly oriented LLC or short weak medial crura followed by long nasal septum. We advocate the use of our surgical algorithm as a stepwise approach for correction of the long nose, however every operation should still be tailored accordingly to each patient.

CONFLICT OF INTEREST

There are no conflicts of interest.

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