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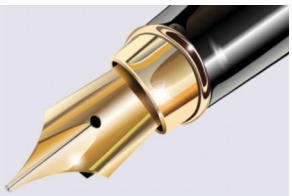

The medical landscape stands on the brink of a profound transformation, and nowhere is this evolution more vivid than within our own specialty. For decades, the structural anatomy of the head and neck has presented an unforgiving terrain for surgeons. Accessing deep-seated lesions of the oropharynx historically demanded a daunting trade-off, often forcing us to execute highly morbid, open procedures like mandibulotomy just to achieve adequate visualization. These classic approaches, while oncologically sound, frequently left patients facing prolonged intensive care stays, permanent swallowing disorders, and severe cosmetic changes. Today, however, the dawn of Transoral Robotic Surgery, or TORS, has completely rewritten this narrative, turning what used to be aggressive, open operations into elegant, ultra-precise, minimally invasive interventions.

This shift represents much more than a simple upgrade in our surgical tools; it is a fundamental leap beyond our own human and anatomical limitations. By utilizing specialized single-port robotic systems, we can now manoeuvre effortlessly through natural orifices, entering the mouth with tools that possess agility far superior to human hands. Where a surgeon's fingers might struggle with a lack of space, multi-jointed robotic instruments offer seven full degrees of freedom, bending around anatomical corners with ease. When coupled with software that filters out natural microscopic hand tremors and scales down our movements, the robot provides a level of microscopic accuracy that was previously unimaginable. Furthermore, high-definition three-dimensional magnification brings the intricate tissue planes of the throat into stunningly sharp focus, allowing for meticulous, millimetre-by-millimetre dissection.

While TORS has established its dominion in the soft tissues of the pharynx, this revolution is also breaking ground in the rigid, microscopic realms of otology and skull base surgery. Here, the challenge shifts from navigating deep pathways to managing unyielding bone and millimetric tolerances. In otology, robotic assistance is stepping in to perform delicate tasks like cochlear implant electrode insertion, where steady, automated advancement minimizes trauma to the fragile inner ear structures. Similarly, in anterior and lateral skull base surgeries, micro-robotic arms and navigated drill systems assist us in carving pathways around critical neurovascular bundles. By maintaining steady trajectories that human muscles cannot sustain over long hours, these systems expand our reach into deep cranial corridors, drastically reducing the risk of catastrophic vascular or nerve injury.

The tangible benefits of this collective technological leap are felt most profoundly by our patients, particularly those navigating the rising tide of human papillomavirus-related oropharyngeal cancers or complex cranial base pathologies. By eliminating the need for extensive external incisions, robotic surgery preserves critical anatomical structures, leading to significantly shorter hospitalizations and a

much faster return to a normal quality of life. Yet, as we look to the horizon, the true potential of this technology is expanding even further through its convergence with artificial intelligence. As we see computational systems mature, AI is stepping into the operating theatre as an intraoperative co-pilot. In the near future, real-time computer vision will seamlessly overlay anatomical roadmaps onto our surgical screens, alerting us to hidden internal carotid arteries or facial nerves, while advanced tissue tracking will help us clearly differentiate malignant tumor margins from healthy tissue.

Despite these incredible strides, our community currently sits in a critical transitional phase that requires careful navigation. The unique constraints of otolaryngology mean we must operate inside remarkably narrow spaces, which makes the adaptation of bulkier robotic systems quite challenging. Furthermore, the high financial costs of acquiring and maintaining this equipment, combined with steep learning curves for training clinicians, remain significant hurdles to widespread adoption across our regional healthcare centres. To usher in this future responsibly, we must demand robust validation, multicentre clinical research, and a commitment to structured training protocols. By maintaining a strict human-in-the-loop framework where clinical judgment always reigns supreme, we can ensure that these automated advancements serve as a trusted ally. Ultimately, surgical robotics is not here to replace the touch of the surgeon, but to elevate our capabilities, safeguard our patients, and refine the art and science of medicine.

Dr Saumitra Kumar

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Main Article

Viability of Tinnitus Handicap Inventory in Management of Idiopathic Subjective Tinnitus

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Saai Ram Thejas,[1] Nampally Prashanth,[1] Ponnuru Pranay[1]

ABSTRACT

Introduction

Idiopathic Subjective Tinnitus (IST) is an auditory condition perceived without an external stimulus and lacks identifiable cause which makes it very difficult to treat. The Tinnitus Handicap Inventory (THI) is a validated tool to assess the severity and impact of tinnitus which has been used extensively since it is practically free. This study evaluates the role of THI in monitoring treatment efficacy in IST.

Materials and Methods

A prospective observational study was conducted at a rural South Indian hospital involving 100 patients aged 21–60 years with IST of at least one year duration. Patients had audiometry to exclude objective causes. THI scores were recorded pre- and post-treatment (12 weeks) with Caroverine, Tocopherol, Levocarnitine, Tinnitus Retraining Therapy (TRT), and Cognitive Behavioral Therapy (CBT).

Results

The mean pre-treatment THI score was 44.92 (moderate), improving significantly to 15.78 (slight) post-treatment ($p<0.01$). 64.87% overall symptom improvement was observed. Notably, the symptom of "desperation" improved by 98.71%, while "insecurity" improved by 16.36%. No patients worsened or dropped out during the study.

Conclusion

THI is a viable, practical tool for diagnosis, grading, and follow-up of IST. Caroverine is an ideal first line drug for the management of IST.

Keywords

Tinnitus Handicap Inventory; Idiopathic Subjective Tinnitus; Caroverine; Tinnitus Retraining Therapy

The term Tinnitus is derived from the Latin word tinnire which refers to a condition in which an individual experiences a ringing, buzzing or hissing auditory sensation in the absence of an external stimulus. It is usually a common symptom which has been cited in literature for about 150 years.[1]

Most cases of tinnitus are subjective and has no antecedent cause, meaning the examiner cannot hear it. However, objective tinnitus can arise from organic causes and can be heard by the examiner. This makes it easier to treat an objective tinnitus as there is an identifiable cause to it.

The causes of Tinnitus can vary from causes in the external ear canal (wax, discharge, foreign body), middle ear (otitis media), inner ear (Meniere's disease), malignancies (Acoustic Neuroma), neurologic causes like Multiple Sclerosis, psychiatric illnesses like Depression and Anxiety among others.

Idiopathic Subjective Tinnitus (IST) is the most common form affecting adults and it is a diagnosis based on elimination of causes. It excludes all known causes like tinnitus associated pathology of the cochlea/nervous system or tinnitus that is susceptible to somatic modulation.[2]

Tinnitus Handicap Inventory (THI) is a tool which helps in analysis of the impact the disorder makes to the Quality of Life of the affected individual. It was first formulated in 1996 and has been in use ever since.[3] It has 25 questions which assesses various symptoms which are associated with Tinnitus.

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The management of Tinnitus is usually complicated and the disorder is hard to treat. Since the etiology is still unclear, a lot of drugs have been used for the management of Tinnitus till date. A few examples are Gabapentin [Gamma-Aminobutyric Acid analogue], Fluoxetine [Selective Serotonin Reuptake Inhibitor], Acamprosate [N-methyl D-aspartate receptor antagonist] among others. Psychotherapy and auditory rehabilitation have also been used.

Caroverine acts as an antagonist of calcium and non-NMDA and NMDA glutamate receptors.[4] Cochlear synaptic tinnitus arises from a synaptic disturbance of NMDA or non-NMDA receptors on the afferent dendrites of the spiral ganglion neurons. This antagonistic activity helps in alleviating the symptoms.

Tinnitus Retraining Therapy [TRT] forms a cornerstone in the management of the annoyance the sound causes in the individual. Masking a particular location of a sound in an environment can help in reducing the impact of the disorder.[5]

The aim of this study is to achieve an outreach in the community and reduce misdiagnosis which can be created in the absence of documentation of the intensity of symptoms. The THI can help in this scenario since it is practically free and can be used easily in both the educated and uneducated sections of the society.

Materials and Methods

Source: From all Departments of a Rural Hospital in South India where any in-patient or out-patient complained of a ringing or buzzing sensation in the ears (unilateral or bilateral). Ethical committee clearance was obtained from the "RVM Institute Ethical Board" viz reference number RVM/22/94.

Sample Size: It was calculated with the formula 4pq/L2, wherein p was present prevalence [29.3%], q was 100-p and l was allowable error [5%]. Based on previous studies in similar populations, a sample size of 95 [closest round off value of 100] was taken.[6]

Statistical Analysis: All statistical analyses were performed using SPSS Statistics 19 for Windows (IBM Corp., Armonk, NY, USA). Samples were compared and evaluated by means of a Paired T-Test. The confidence interval was set at 95% and 5% margin of error was given.

Inclusion criteria:

1. Idiopathic origin of Tinnitus.
2. Subjective Tinnitus.
3. Age group 21-60.
4. Individuals willing for follow up over 12 weeks with respect to pharmacological therapy and auditory rehabilitation.
5. Duration of symptoms of at least 1 year with no symptomatic relief.

Exclusion criteria:

1. Non-consenting individuals.
2. Presence of an antecedent cause of Tinnitus.
3. Individuals on long term medication causing Tinnitus which could not be stopped.[7]
4. Auditory hallucination misdiagnosed as tinnitus in the past and needing a psychiatric referral.
5. History of previous ear surgeries.

Method of assessment: All patients presenting with Tinnitus were considered for the study at first. Individuals meeting the strict inclusion and exclusion criteria went ahead and their data was documented after obtaining written informed consent. Any associated complaint which warranted further Radiological Evaluation via MRI or CT (viz. headache, vertigo, loss of consciousness), the investigation was done and such patients were re-evaluated by the concerned Department. A Neurological and Psychiatric examination was done to rule out evident causes.

In the presence of a local cause (Otitis Media/ Labyrinthitis/Wax and Discharge of External ear Canal/ Endolymphatic Hydrops/Vestibular Schwannoma/Tumors of Cerebellopontine Angle and other malignancies/ Meniere's disease/Palatal Myoclonus/Semicircular Canal Dehiscence), the case was managed adequately and excluded from the study.

Each patient underwent a Pure Tone Audiometry

(PTA) and Impedance Audiometry (IA). They were included only if the findings of the Audiometry were normal.

At the end of this ordeal, the cases with Idiopathic Subjective Tinnitus made it to the final study irrespective of the duration of the symptom.

After obtaining informed consent from each patient, each patient filled out the THI proforma (Images 1 and 2) in the presence of the same researcher and a reliable relative by his/her side to prevent bias. Each question carried three options (viz. 0,2,4) and could make a score from 0-100. The severity was graded based on previous studies.[8]

Each patient was started on the following treatment protocol:

1 Tablet Caroverine 20 milligrams, two tablets a day after breakfast and dinner for 12 weeks.

1 Tablet Tocopherol 400 milligrams, one tablet a day after lunch for 12 weeks.

1 Tablet Levocarnitine 150 milligrams, one tablet a day after lunch for 12 weeks.

1 Tinnitus Retraining Therapy with White Noise on a daily basis for 4 hours per day.[9]

1 Cognitive Behavioural Therapy (CBT) to reach about 7-8 hours of sleep in the night without Pharmacotherapy.

The patient was monitored and the same THI (Figure 1 and 2) and was given at the end of 12 weeks. Any patient who did not improve as expected at the end of the study was evaluated further and kept on regular follow-up.

Tinnitus Handicap Inventory

Instructions: The purpose of this questionnaire is to identify problems your tinnitus may be causing you. Check **Yes**, **Sometimes**, or **No** for each question. Do not skip a question.

		Yes (4)	Sometimes (2)	No (0)
1F	Because of your tinnitus is it difficult for you to concentrate?	☐	☐	☐
2F	Does the loudness of your tinnitus make it difficult for you to hear people?	☐	☐	☐
3E	Does your tinnitus make you angry?	☐	☐	☐
4F	Does your tinnitus make you feel confused?	☐	☐	☐
5C	Because of your tinnitus do you feel desperate?	☐	☐	☐
6E	Do you complain a great deal about your tinnitus?	☐	☐	☐
7F	Because of your tinnitus do you have trouble falling to sleep at night?	☐	☐	☐
8C	Do you feel as though you cannot escape your tinnitus?	☐	☐	☐
9F	Does your tinnitus interfere with your ability to enjoy social activities (such as going out to dinner, to the movies)?	☐	☐	☐
10E	Because of your tinnitus do you feel frustrated?	☐	☐	☐
11C	Because of your tinnitus do you feel that you have a terrible disease?	☐	☐	☐
12F	Does your tinnitus make it difficult for you to enjoy life?	☐	☐	☐
13F	Does your tinnitus interfere with your job or household responsibilities?	☐	☐	☐
14F	Because of your tinnitus do you find that you are often irritable?	☐	☐	☐
15F	Because of your tinnitus is it difficult for you to read?	☐	☐	☐
16E	Does your tinnitus make you upset?	☐	☐	☐
17E	Do you feel that your tinnitus problem has placed stress on your relationship with members of your family and friends?	☐	☐	☐
18F	Do you find it difficult to focus your attention away from your tinnitus and on other things?	☐	☐	☐
19C	Do you feel that you have no control over your tinnitus?	☐	☐	☐
20F	Because of your tinnitus do you often feel tired?	☐	☐	☐
21E	Because of your tinnitus do you feel depressed?	☐	☐	☐
22E	Does your tinnitus make you feel anxious?	☐	☐	☐
23C	Do you feel that you can no longer cope with your tinnitus?	☐	☐	☐
24F	Does your tinnitus get worse when you are under stress?	☐	☐	☐
25E	Does your tinnitus make you feel insecure?	☐	☐	☐
	Total	___	___	___

F denotes an item on the functional subscale; E, an item on the emotional subscale; and C, an item on the catastrophic response subscale.

Newman, C. W., Jacobson, G. P., & Spitzer, J. B. (1996). Development of the Tinnitus Handicap Inventory. *Archives of Otolaryngology—Head and Neck Surgery, 122*, 143–148.

Fig. 1. Questionnaire of Tinnitus Handicap

GRADE	SCORE	DESCRIPTION
1	0-16	Slight: Only heard in quiet environment, very easily masked. No interference with sleep or daily activities.
2	18-36	Mild: Easily masked by environmental sounds and easily forgotten with activities. May occasionally interfere with sleep but not daily activities.
3	38-56	Moderate: May be noticed, even in the presence of background or environmental noise, although daily activities may still be performed.
4	58-76	Severe: Almost always heard, rarely, if ever, masked. Leads to disturbed sleep pattern and can interfere with ability to carry out normal daily activities. Quiet activities affected adversely.
5	78-100	Catastrophic: Always heard, disturbed sleep patterns, difficulty with any activity.

Fig. 2. Grading of the severity of Tinnitus

Observations and Results

Table I : Age and Gender distribution

AGE GROUP	NUMBER (N=100)	
	MALE	FEMALE
21-30	6	8
31-40	13	21
41-50	11	18
51-60	8	15

As seen in Table I, the study had 38 male and 62 female participants. The most common age group affected was between 31 and 40.

As seen in Tables II and III, the improvement was clinically significant after 12 weeks as evidenced by a p-value of <0.05. On the whole, the symptoms improved by 64.87%. A vast majority of patients improved from moderate and severe to slight and mild disturbance. None of the patients remained in or worsened to the catastrophic zone. The mean THI before the treatment was 44.82 (moderate) and the mean after treatment was 15.78 (slight).

The average duration of Tinnitus for all patients in the study was 9.3 ± 2.5 years. Among the 100 patients taken in the study, 78% of them were exposed to loud sounds at their workplace (factory workers, street hawkers and drivers) for at least a duration of 5 years (p<0.05).

Table II : Paired Samples Correlations for THI before and after 12 weeks of treatment

	PAIRED DIFFERENCES					T	SIG.	CORRELATION
	MEAN	STANDARD DEVIATION	STANDARD ERROR MEAN	95% CONFIDENCE INTERVAL OF THE DIFFERENCE				
				LOWER	UPPER			
Before vs After	29.14	17.42	1.74	25.68	32.60	16.73	0.01	0.462

Table III : Paired Sample Statistics for THI before and after 12 weeks of treatment

	MEAN	N	STANDARD DEVIATION	STANDARD ERROR OF MEAN
Before	**44.92**	**100**	**19.41**	**1.94**
After	**15.78**	**100**	**11.67**	**1.17**

The symptom which improved the most was the feeling of desperation because of the tinnitus (98.71% better after treatment). The symptom which improved the least was the feeling of insecurity (16.36% better after treatment). 17 of the 25 symptoms improved by at least 50% post the treatment.

None of the patients dropped out of the study in the middle for further medical or surgical needs.

Discussion

Since the management of Tinnitus of any form is highly difficult, a lot of methods have been used for the same over a number of years. The most commonly used methods include Tinnitus Retraining Therapy.[10] Customized Music Therapy (CMT),[11] NMDA receptor antagonists,[12] Hearing Aids,[13] Brain Stimulation[14] among others.

A study conducted by Roberts et al in 2010 concluded that increasing age, and Sensorineural hearing loss are the most common risk factors for Tinnitus. They also said that with an increase in professional noise and excess stimulation of the cochlea during leisure times, the prevalence of tinnitus is expected to rise.[15]

In a study conducted in 2021 by Ledesma et al, it was seen that the average THI was 36 in the study group and 32 in the control group. The average age of presentation of the patient to the study was 52 years.[16] This did not correlate well with our study as the average age of presentation was 34 years and the average THI was 45. This discrepancy can be attributed to our study group which included only Idiopathic Subjective type of Tinnitus and probably the etiology which had exposure to sounds at the work place.

Our study correlated well with Biswas et al's study in 2023 wherein they said that environmental influences that damage the auditory system such as the exposure to loud noise can also trigger tinnitus.[17] Our study also included participants who had some sort of exposure to loud sounds at workplace for at least a duration of 5 years.

In 2024, Dash et al reported that the THI improved by 53.3% post the use of monotherapy Caroverine for 90 days in cases of Tinnitus.[18] This correlated well with our study wherein the symptoms improved by 64.8% after the same study period. The slight betterment can be because of the addition of Levocarnitine, Tocopherol and TRT.

In 2020, Gos et al reported that THI is a reliable uni dimensional scale to evaluate tinnitus severity. The dimensionality of THI was evaluated by them using several models of Confirmatory Factor Analysis and an Item Response Theory approach and it proved to be apt as a first use tool.[19] The same holds good in our study since use of complicated testing mechanisms are not always freely available in all rural setups.

A study by Dehkordi et al in 2015 said that in cases of improper management or non-treatment of IST, it can cause increase in neuroticism and decrease in extraversion.[20] As this is a rare entity and diagnosis can also be difficult, management should be prompt and quick so as to prevent personality changes.

Conclusion

Idiopathic Subjective Tinnitus is a difficult diagnosis as it is done by exclusion which requires immense knowledge and resources from the side of the physician and patience from the side of the patient. Once the diagnosis is made, management is fairly straightforward but needs adequate monitoring. This can be achieved by the Tinnitus Handicap

Inventory which is easy to use and has good validity. Caroverine is easily procurable and does not have any toxicity which makes it a good first line drug for the management of Idiopathic Subjective Tinnitus.

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Main Article

Surgery or Watchful Waiting? Dilemma in Managing Facial Palsy Following Temporal Bone Fracture

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ABSTRACT

Introduction

Post-traumatic facial nerve paralysis (FNP) is challenging, often leaving surgeons in a dilemma between conservative management and surgical intervention. This study was done to evaluate the clinical outcome of FNP resulting from temporal bone fracture (TBF).

Materials and Methods

A prospective observational study was conducted on patients with radiologically confirmed TBF. FNP was identified in 51 cases and graded using House-Brackmann grading system.

Results

Of the 69 cases included in the study, 51 patients exhibited FNP. 34 patients were included in immediate onset (21/34 had indeterminate onset) group and 17 patients were included in delayed onset group. All patients received oral corticosteroids initially. Follow-ups were conducted at 15, 30, 90 and 180 days. Seven patients who showed no signs of reinnervation on electromyography at day 30 were advised to undergo surgical intervention. Only three patients opted for facial nerve (FN) decompression, while four declined surgery. At six-month follow-up, 49 patients (including two post-surgical cases) demonstrated following outcomes: 26 patients improved to HB grade I, 15 to grade II, five to grade III, two to grade IV, and one to grade V. Among the three patients who underwent FN decompression, two improved from grade V-IV to grade III. Of four patients who refused surgery, three remained at HB grades IV-V. Over extended follow-up, one patient deteriorated to grade VI by 54 weeks, while the other two improved to grade II by 64 and 70 weeks, respectively.

Conclusion

Immediate onset post-traumatic FNP has the potential for spontaneous recovery without surgical decompression.

Keywords

Facial Nerve; Temporal Bone; Skull Fracture; Facial Paralysis; Decompression

The temporal bones (TB) form part of the skull base, situated between the sphenoid and occipital bones. Despite their thickness and durability, these bones contain several foramina that create areas of relative weakness, making them susceptible to traumatic injury. The incidence of such fractures has increased significantly in recent years, largely due to high-impact incidents such as road traffic accidents (RTAs), assaults, and sports-related injuries. Temporal bone fractures can cause substantial morbidity due to damage to structures such as the external auditory canal (EAC), ossicles, cochlea, vestibule, semicircular canals, auditory-vestibular nerve, and facial nerve (FN). Severe trauma may also involve the carotid artery or jugular vein, resulting in life-threatening haemorrhage.

In cases of temporal bone fractures, the management of life-threatening injuries often takes precedence, potentially leading to delayed recognition of facial paralysis. This delay complicates treatment and rehabilitation, resulting in long-term functional impairment and diminished quality of life. This study explores the management options for facial nerve paralysis (FNP)

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following temporal bone fractures, focusing on clinical outcomes and treatment strategies.

Materials and Methods

This prospective observational study was conducted at a tertiary care hospital over three years. It involved a consecutive cohort of patients with TB fractures. Ethical approval was obtained from the institutional ethics committee (Approval no. 2847A/2022-23), and the study itself was conducted from January 2021 to December 2023, with patient recruitment and follow-up occurring over this 3-year period. The study was conducted in accordance with the Declaration of Helsinki.

Patients were referred to the Department of Ear, Nose, and Throat (ENT) either directly from the trauma center or from the departments of neurosurgery or maxillofacial surgery. Inclusion criteria were patients with documented TB fractures on high-resolution computed tomography (HRCT) and evidence of FNP.

The onset of paralysis was categorized as immediate onset if FNP was documented within 24 hours after sustaining the injury and delayed onset if later than that. Patients with indeterminate onset were considered in immediate onset group.

Exclusion criteria: (i) Any pre-existing FN condition such as Bell's palsy, or prior mastoid/facial surgery with injury to FN. (ii) Any maxillofacial injury that could preclude evaluation of FN function. (iii) Patients unwilling to provide informed consent.

Data Collection: Detailed case histories were recorded, including the date and nature of the trauma, initial treatment, and the onset and progression of otologic symptoms. A thorough ENT examination, including a neurotologic assessment, was performed. HRCT of the temporal bone was obtained to document fracture lines, determine the extent of trauma, and correlate radiologic findings with clinical symptoms.

Treatment Protocol: Patients with FNP were initially treated with oral prednisolone (1 mg/kg/day) for five days. None of the patients had received steroids before presentation in the ENT department. Recovery was categorized using the House-Brackmann (HB) scale:

(i) Complete recovery: Patients who achieved House-Brackmann (HB) grade I.

(ii) Partial recovery: Patients who achieved HB grades II-IV.

(iii) No recovery: Patients who achieved HB grades V-VI.

Treatment was reassessed on the sixth day. If improvement was observed, the dose was tapered over five days. Based on our treatment protocol, in cases with no improvement or worsening, the treatment was continued for an additional five days, followed by tapering. Electromyography (EMG) was performed on 12 patients who had no observable improvement in FN function after one month of conservative treatment irrespective of the grade of FNP at the time of presentation. Seven patients with no regenerative potential on EMG were considered for FN decompression. Three patients underwent surgery on the 33rd, 37th, and 101st day respectively, while four patients declined surgery. Operated patients were followed up for more than six months, while one patient was lost to follow-up.

Surgical Technique: In all three patients the fracture line was undisplaced and involved the second genu and tympanic segment, second genu and mastoid segment, mastoid segment alone respectively. A transmastoid approach was used, involving mastoidectomy, exposure of the short process of the incus, transmastoid atticotomy, and posterior tympanotomy which was extended superiorly to visualise the tympanic segment and first genu of FN. Incus and malleus head were removed in all three cases irrespective of hearing status to achieve good exposure. The FN was decompressed from the first genu to the stylomastoid foramen by removing bone 180 degree around the nerve's circumference, and small bony fragments impinging on the nerve were removed. The nerve sheath was slit using an ophthalmic knife. The ossicular chain was reconstructed by interposing the incus between the stapes and malleus.

Complete nerve transection was not seen in any of the three patients. In two patients, small bony fragments were seen impinging on the FN in the mastoid segment which were not identified radiologically. These fragments were removed atraumatically. In one patient who had

involvement of tympanic segment and second genu, though no bony fragments were impinging on the nerve, a small intraneural haematoma was seen underneath the intact epineurium which was evacuated once the nerve sheath was slit open.

Results

The study included 69 patients, with 61 (88%) males and 8 (12%) females. The mean age was 33.1 years (SD ± 9.5), with most patients in the 21-40 age group. Road traffic accidents accounted for 57 (83%) of the cases, with other causes including falls, sports injuries, and assaults.

Otological Features: Patients commonly presented with ear bleeding/discharge, hearing loss, tinnitus, vertigo, and facial asymmetry [Table I]. Other clinical signs included Battle's sign, mastoid tenderness, lacerations of the EAC, tympanic membrane perforation, hemotympanum, FNP, and cerebrospinal fluid (CSF) otorrhea.

Table I: Otological manifestations of patients with fracture temporal bone

SYMPTOMS	NUMBER (%)
Ear bleed	29 (42%)
Hearing loss	38 (55%)
Tinnitus	12 (17%)
Vertigo	10 (14%)
Facial asymmetry	51 (74%)
SIGNS	**NUMBER (%)**
Battle sign	12 (17%)
Mastoid tenderness	20 (29%)
External canal laceration	31 (45%)
Tympanic membrane perforation	5 (7%)
Haemotympanum	23 (33%)
Hearing loss	38 (55%)
Nystagmus	2 (3%)
Facial nerve palsy	51 (74%)
CSF otorrhea	4 (6%)

Fracture Patterns: HRCT revealed that most fractures were longitudinal (67%) [Fig 1 (A)], with a higher incidence of oblique fractures compared to transverse fractures [Fig 1 (B)]. The tympanic, mastoid, and first genu segments of facial canal were most commonly affected [Table II].

In most cases, fractures were undisplaced, with only two documented cases of displaced fractures [Fig 1 (C)]. The facial canal was involved in 34 (49.3%) cases [Fig 1 (D)].

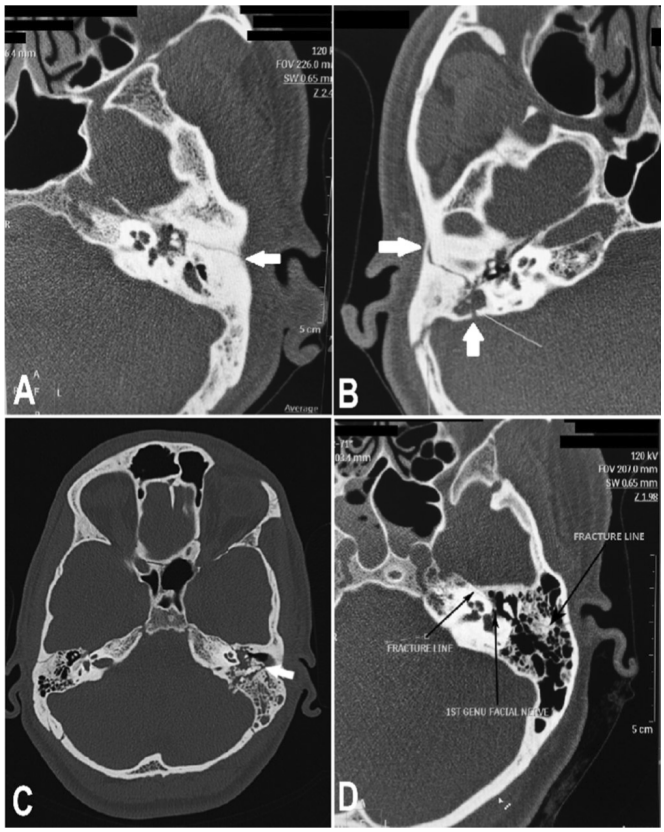

Fig. 1. High resolution CT scan of temporal bone. (A) Axial image shows longitudinal fracture line involving the left temporal bone (white arrow). (B) Axial image shows an oblique fracture line involving the right temporal bone (white arrow). (C) Axial image shows displaced bony fragments along the fracture line (white arrow). (D) Axial image shows a fracture line in the left temporal bone involving the first genu of the facial nerve (black arrow)

Table II: Pattern of temporal bone fracture line in patients with post-traumatic facial nerve paralysis

PATTERN OF TEMPORAL BONE FRACTURE (N= 69)		NUMBER (%)
Type of fracture according to the plane of fracture line	Longitudinal	46 (66.7%)
	Transverse	8 (11.6%)
	Oblique/ mixed	15 (21.7%)
Type of fracture according to involvement of otic capsule	Otic capsule involving	16 (23.18%)
	Otic capsule sparing	53 (76.8%)
Fracture line involving Facial canal	First genu	6 (17.6%)
	Second genu	5 (14.7%)
	Labyrinthine segment	1 (2.9%)
	Tympanic segment	9 (26.5%)
	Mastoid segment	6 (17.6%)
	1st genu & tympanic segment	2 (5.9%)
	2nd genu & tympanic segment	3 (8.8%)
	2nd genu & mastoid segment	2 (5.9%)

Facial Palsy Outcomes: Lower motor neuron FNP was observed in 51 (74%) patients. Overall, 13 cases were immediate onset of which 7/13 presented to the ENT specialist on the same day; cases detected between Day 2-5 had indeterminate onset, of these 15/21 patients presented for treatment during that timeframe [Fig 2]. 17 cases were delayed onset and presented later, typically in the 2nd or 3rd week following the onset of symptoms. The severity of facial palsy was classified using the House-Brackmann (HB) scale, with 19 patients in grade V, 9 in grade IV, 7 in grade III, and 16 in grade II. [Fig 3].

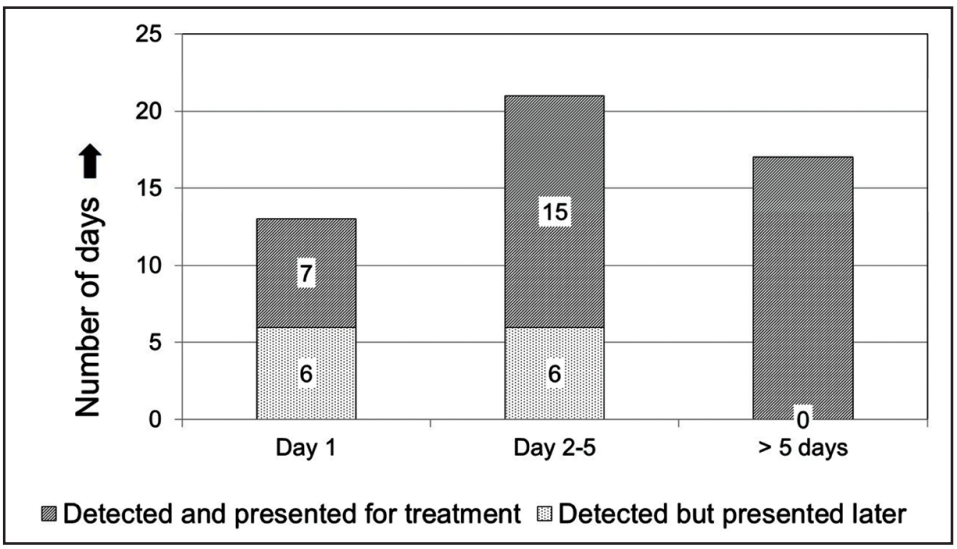

Fig. 2. Day of detection and day of presentation for ENT consultation in the immediate onset post-traumatic facial nerve paralysis group (n=34)

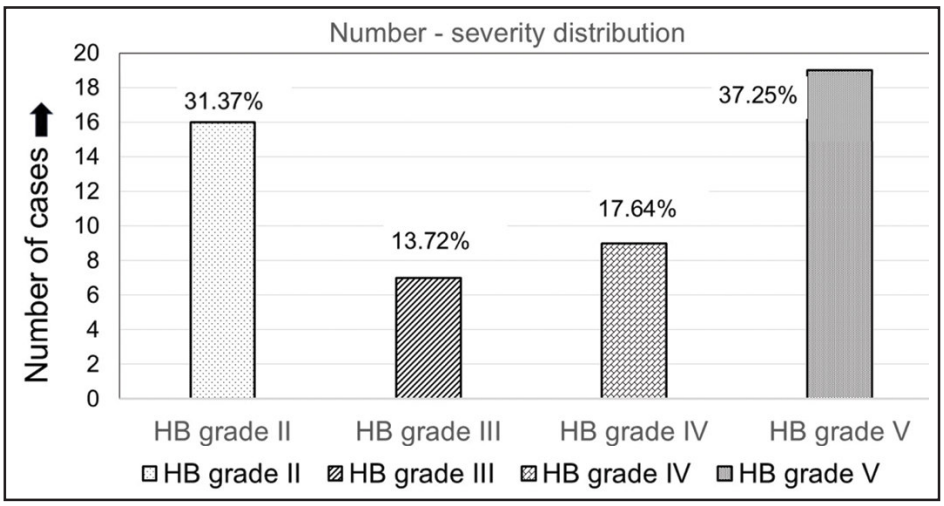

Fig. 3. **Distribution of post-traumatic facial nerve paralysis as per House Brackmann**

FN recovery was assessed at days 15, 30, and 90 [Fig 4]. On day 15, clinically significant recovery was noted, with two patients achieving HB grade I (two cases), and others improving to grades II (16 cases), III (11 cases), and IV (8 cases). However, 14 patients (grade V) showed no improvement by day 15. By day 30, improvements were more pronounced, with 11 patients achieving grade I recovery, 19 improving to grade II, eight cases to grade III. Twelve patients (who belonged to the immediate onset group) did not show satisfactory recovery (grade IV-V) by day 30. Of these, seven showed no reinnervation potential on EMG and were planned for surgical decompression. Three patients underwent surgery on the 33rd, 37th, and 101st day, respectively while four declined surgical intervention. One patient with unsatisfactory recovery who had declined surgical intervention succumbed to neurosurgical complications. The outcomes of facial palsy cases, excluding those who underwent surgical decompression (47 cases), were evaluated at day 90 [Table III]. At the 90-day follow-up, 55.31% of patients showed complete recovery (HB grade I), 36.17% had partial recovery (grades II-IV), and 8.51% had no recovery (grade V).

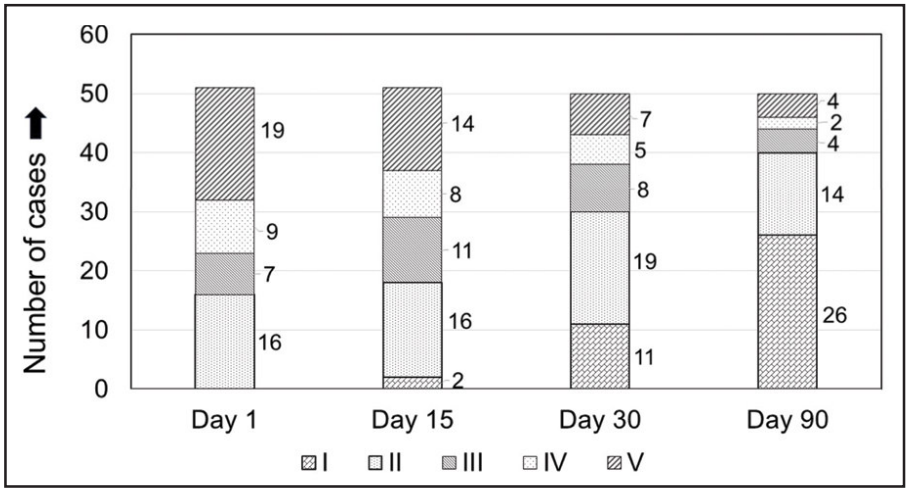

Fig. 4. Pattern of House Brackmann grade of recovery in cases of post-traumatic facial nerve paralysis over 90 days

Table III: Outcome of facial palsy at 90 days of follow-up in 47 unoperated patients of post-traumatic facial nerve paralysis

LEVEL OF RECOVERY FROM FACIAL PALSY	NO. OF CASES(N=47)	PERCENTAGE (95% CI)
Complete recovery (HBG I)	26	55.31% (41-69%)
Partial recovery (HBG II-IV)	17	36.17 % (23-50%)
No recovery (HBG V-VI)	04	8.51 % (3-20%)

HB Grade- House Brackmann grade

Long-term Follow-Up (upto or more than six months): Overall, 49 patients, which also includes two cases who underwent surgical management were analysed at six months - 26 patients were classified as HB grade I, 15 as grade II, five as grade III, two as grade IV (both had declined surgical intervention), and grade V-one case (had declined surgical intervention) [Table IV]. Of the three patients who underwent surgery, two improved to HB grade III from HB grade IV and V respectively while one was lost to follow up.

Three patients with HB grade IV and V, all of whom had declined surgical intervention, were regularly monitored. Two of these (one with grade IV and one with grade V) had displaced fracture segments on HRCT. Two patients (one of them with displaced fracture segment on HRCT) recovered to HB grade II by 64 and 70 weeks, respectively, over time, one patient progressed to HB grade VI by 54 weeks (had displaced fracture segment on HRCT). EMG was repeated for this patient at 54 weeks. It showed presence of sharp positive waves and fibrillation potentials in the mentalis muscle indicative of active denervation. This patient was advised surgical intervention at 54 weeks which he again declined. After 54 weeks this patient could not be followed up.

Table IV: House Brackman Facial nerve grading of patients (n=51) over more than six-month period of observation

GRADE	D 1	D 15	D 30	D 90	D 180	>50 WEEKS
I	0	2	11	26	26	26
II	16	16	19	14	15	17
III	7	11	8	4	5	5
IV	9	8	5	2	2	0
V	19	14	7	4	1	0
VI	0	0	0	0	0	1
Total	51	51	50	50	49	49

*One patient succumbed to his neurosurgical morbidity before day 30; another patient who underwent facial nerve decompression was lost to follow-up post-surgery hence only 49 out of 51 patients were available for long-term follow-up

Discussion

FNP can be classified into two broad categories: iatrogenic and accidental. Iatrogenic cases, typically due to neurotologic surgeries, account for approximately 20% of all FNP cases. The remaining 80% result from trauma, particularly fractures of the temporal bone (TB).[1] In our study, RTA's were the leading cause of TB fractures, which is consistent with findings from Mishra et al, but differs from studies in Western countries where falls are often cited as the predominant cause of TB fractures.[2-5]

The complex anatomy of the FN as it traverses the TB makes it vulnerable to injury in multiple locations, depending on the nature of the fracture. Our study found a notably high incidence of FNP (74%) following TB fractures, which is significantly higher than the 1.6% and 7% reported by Schuble and Brodie, respectively, in Western studies.[4,5] Yetiser's study, however, reported a similarly high incidence (68.57%).[6] This disparity may reflect differences in trauma patterns, driving behaviors, and safety measures between regions, which could contribute to the increased frequency of TB fractures and subsequent FNP in our cohort.

Post-traumatic FNP can be either immediate onset or delayed onset. The aetiology of delayed-onset facial palsy following temporal bone fracture is debatable. Unlike immediate facial palsy, which is usually attributed to direct nerve transection or severe mechanical disruption, delayed palsy is conjectured to result from either progressive neural oedema within the bony fallopian canal, intraneural or perineural hematoma formation, which results in nerve compression, vascular compromise leading to ischemic damage, stretching of the nerve or inflammatory demyelination. The narrow labyrinthine segment is most vulnerable due to its limited capacity to accommodate nerve oedema. As there are more chances of preservation of axonal continuity, a favourable prognosis compared to immediate complete palsy is expected.

Mechanisms of FN Injury and HRCT Findings: High-resolution CT (HRCT) scans play a crucial role in identifying FN injury in TB fractures, particularly fractures of the bony facial canal, displacement of bone fragments, or impalement of the nerve by bone fragments, which can help guide treatment decisions.[7] In our cohort, the tympanic segment of the FN was the most frequently injured (26.5%), a finding that contrasts with the geniculate ganglion being the most affected site in other studies (30-80%).[8] This highlights the importance of a comprehensive evaluation of the FN, considering various potential sites of injury.

The management of FNP, particularly in cases with immediate complete onset, often poses a clinical dilemma: to proceed with conservative management or opt for surgical decompression. The decision is influenced by factors such as the timing of onset, the degree of nerve damage, and the presence of radiological signs of severe injury as mentioned above. The extent of facial nerve injury is a key factor in determining functional recovery and long-term prognosis. Mild injuries corresponding to neuropraxia demonstrate early and near-complete recovery due to preserved axonal integrity. In contrast, axonotmesis is followed by Wallerian degeneration and requires the axon to regenerate, resulting in delayed and incomplete recovery. Neurotmesis, which is associated with the disruption of nerve is associated with poor prognosis. Electrophysiological parameters such as CMAP amplitude and increased latency are objective indicators of the degree of injury. Greater reductions in CMAP amplitude correlate with extensive axonal loss and are associated with slower and incomplete recovery. Early evaluation of damage severity aids in prognosis and directs treatment choices.

In cases of delayed or incomplete paralysis, medical management with corticosteroids is typically the first-line treatment, as it can help reduce inflammation and promote nerve recovery.[5] However, for patients with immediate onset complete facial paralysis, the need for surgical intervention remains controversial. While some studies advocate early surgical decompression (within 8 weeks of injury) to minimize long-term damage to the nerve, others suggest that conservative management with steroids may suffice, even in cases where electroneuronography (ENoG) shows severe degeneration of the nerve.[9-11] House's observations suggest that surgery often results in only modest

improvement in FN function, indicating that a cautious, wait-and-see approach may be appropriate in many cases.[12]

Our study supports the idea that conservative management, particularly when combined with corticosteroid therapy, leads to good outcomes for many patients. Only 4 out of 47 conservatively treated patients failed to show improvement by 90 days, and even these cases except one patient showed recovery beyond the 90-day follow-up period. In contrast, both patients who underwent early FN decompression surgery (performed at day 33 and day 37) only achieved a recovery up to HB grade III. Although 2 cases underwent surgical decompression, the comparison with 47 non-surgical cases does not provide statistical significance and should be interpreted as a descriptive observation rather than a definitive conclusion. For patients who did not show improvement within the initial protocol timeframe, extending steroid treatment may be considered on a case-by-case basis. Further research is needed to assess the efficacy of prolonged steroid therapy for non-responders.

Electrodiagnostic tests, such as ENoG and electromyography (EMG), play a pivotal role in predicting the recovery potential of the FN. ENoG can assess the extent of nerve degeneration and provide critical information regarding the likelihood of spontaneous recovery. The chances of spontaneous recovery drop to 50 % if greater than 95% degeneration is documented by ENoG at the end of 2-3 weeks.[13] ENoG may, however, overestimate degeneration because a dyssynchronous response by the regenerating nerve fibres may not contribute to the compound muscle action potential (CMAP). Overall, the role of various electrodiagnostic tests in predicting acute facial nerve paralysis recovery is controversial. Esslen's theory, which proposed that the amplitude of CMAP is directly proportional to the number of degenerated fibres has been challenged by various authors. Sittel et al and Grosheva et al have reported that EMG is a more reliable tool for predicting unfavourable outcomes.[14- 15] In a study by Grosheva et al, ENoG prognosis was correct only in 73% patients compared to EMG, which correctly predicted recovery in 97% patients. In the same study, sensitivity, specificity, positive predictive value, and negative predictive value of EMG was reported to be higher than ENoG.[16] Due to the unavailability of ENoG in our institution, we relied on EMG to guide our treatment decisions. EMG, while useful in detecting denervation and reinnervation, has limitations, particularly in the early phase of injury.

Considering surgical decompression in patients who do not show recovery by 4–6 weeks, particularly if ED tests suggest either significant degeneration (ENoG) or lack of reinnervation (EMG) may appear a prudent clinical decision. Alternatively, if radiological evidence suggests mechanical compression or transection of the FN it can be done earlier.[13, 17] The optimal timing for surgical intervention remains a subject of debate, with Fisch advocating for decompression within the first 3 days, while others suggest waiting for 20-21 days to allow for optimal axoplasmic flow; or Thakar et al, who advocate super-selection of cases to operate only after 16-18 weeks.[11, 18-19] Our study found that despite surgical decompression (average timing of decompression 5-14 weeks) in three patients with unfavourable clinical and electrophysiologic response, patients did not have a dramatic recovery at the end of six-month follow-up. On the contrary 98% cases had good clinical recovery with conservative management (46 patients out of 47 improved to grade I-III) including one with displaced fracture segment at six months. This reinforces the view that conservative management for a period of 16-18 weeks as suggested by Thakar et al[11] may be equally effective in many cases of complete FNP.

The literature on the outcomes of surgical decompression versus conservative management is mixed. Several studies, such as those by Liu et al., Quaranta et al, and Gür et al, report good recovery (HB grade I-III) in a significant proportion of patients undergoing surgery.[1, 14, 20] However, studies like that of Darrouzet et al equivocal recovery patterns have been reported with conservative and surgical management in traumatic FNP.[21] Thakar et al treated 28 cases of complete facial palsy following TB fracture with oral steroids and

reported recovery to HB grade I/II in 96% cases, albeit after 24 weeks and 100% had recovered to HB grade I/II/III by 40 weeks.[11] They argue that early surgical intervention for undisplaced longitudinal fractures is 'unjustified' and advocate for clinical judgment regarding surgical treatment in significantly displaced fractured segments with suspicion of nerve transection. Similarly, Nash et al suggest that conservative management leads to a higher rate of full recovery (36% with observation vs. 16% with surgery.[22]

The ongoing debate about the timing and outcome of surgical intervention remains inconclusive. In our study, the majority of patients managed conservatively recovered to HB grades I-III. Surgical intervention was required in a small proportion and did not contribute to a dramatic recovery. The lack of use of ENoG results in surgical decision-making and the small number of patients who received surgical decompression are the limitations of our study.

Ultimately, our findings support a selective approach to surgery, recommending conservative management as the first-line treatment for most cases of traumatic FNP. Surgery should be reserved for cases with substantial nerve damage or those showing no signs of recovery after 3–6 months of observation. Further studies documenting the role of conservative management in patients with poor ENoG and EMG response, though ethically challenging to conduct, are required to validate our findings. Also, studies with larger sample sizes and longer follow-up periods are needed to refine treatment protocols and better understand the long-term outcomes of different management strategies for FNP following temporal bone fractures. In managing post-traumatic FN palsy, our study primarily employed corticosteroid therapy, with surgical intervention reserved for cases where EMG results indicated poor chances of spontaneous recovery. We did not explore rehabilitation strategies or the role of hyperbaric oxygen therapy, both of which may hold promise for improving outcomes in cases of partial or no recovery. Further research should examine these adjunct therapies.

Conclusion

In conclusion, traumatic FN paralysis following temporal bone fractures is a complex condition that requires careful evaluation and management. Our study suggests that most patients with FNP following TB fractures can achieve good recovery through conservative management. Electrodiagnostic tests like ENoG and EMG should be incorporated into the decision-making process when available, as they provide valuable prognostic information and help in selection of cases requiring surgical intervention. Surgical decompression should be reserved for cases where HRCT shows displaced fracture segments indicative of severe nerve damage or nerve transection, or fractured segments are seen along the course of Fallopian canal leading to mechanical compression, or when there is a lack of any sign of recovery after 3-6 months of observation. The utility of HRCT in decision-making should be validated in future studies.

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Main Article

Preservation of Marginal Mandibular Nerve by Direct Visualization during Neck Dissection

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ABSTRACT

Introduction

The marginal mandibular branch of the facial nerve is frequently at risk of injury during neck dissection surgery, causing visible cosmetic deformity and functional problems to the patient. The aim of the study was to assess whether there is any difference in incidence of marginal mandibular nerve palsy, level 1b lymph node yield and operating time between patients in whom the nerve is dissected by traditional methods (Hayes Martin) and where the nerve is directly visualised and dissected.

Materials and Methods

Retrospective review of 45 patients (56 neck dissections) of oral cancer undergoing neck dissection as part of their surgery.

Results

Patients in whom the marginal mandibular nerve is directly visualised and dissected have a statistically significant decreased incidence of post-operative marginal mandibular nerve palsy and higher level 1b lymph node yield than in patients where the nerve is protected by traditional methods, without any significant difference in operating time.

Conclusion

directly visualising the marginal mandibular nerve and dissecting it off the surgical field gives better cosmetic and functional results, as also nodal clearance, in patients undergoing neck dissection for oral cancer, without significantly increasing operating time.

Keywords

Neck Dissection; Oral Cancer; Marginal Mandibular Nerve; Hayes Martin Method; Sandwich Technique; Level 1b Lymph Nodes

The marginal mandibular nerve is an important branch of the facial nerve which supplies the muscles of the angle of the mouth and the lower lip- the depressor anguli oris, the depressor labii inferioris and the mentalis. The course of the nerve frequently exposes itself to injury during surgeries of the neck, especially the upper neck, like submandibular gland surgeries and neck dissections. Injury to this nerve causes significant cosmetic and functional deformities for the patient, manifested as an asymmetric smile and weakness of the angle of the mouth leading to inadequate lip closure and dribbling of saliva or liquids.

Neck dissection is an integral part of the surgical management of oral squamous cell carcinomas. The radical nature of these surgeries frequently leads the surgeon to pay little attention to preserving the marginal mandibular nerve diligently. This leads to frequent injury to the nerve with its attendant cosmetic and functional morbidities.

The marginal mandibular nerve is conventionally tried to be protected from injury by indirect methods of dissection like the Hayes Martin method or the sandwich technique, though these methods are less likely to be foolproof. In this study we aim to compare the conventional methods of marginal mandibular nerve dissection to direct visualization and dissection of the nerve and its effect on incidence of nerve injury and nodal yield. The specific objectives of the study are to compare the

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incidence of marginal mandibular nerve injury, the average nodal yield from the level 1b nodal level and the operating time between the two groups, between two groups–the conventional dissection method with and without direct visualization of the nerve.

Materials and Methods

The study adheres to the ethical guidelines as outlined in the declaration of Helsinki. This was a retrospective study of patients of oral cancer treated with surgery for the primary lesion combined with unilateral or bilateral neck dissection (levels I to IV/V) as the case may be. Data from our departmental registry for the preceding twelve (12) months (December 2023 through December 2024) was analyzed. We included Treatment naïve patients of oral cancer (buccal mucosa, tongue) and patients whose primary tumors were accessed either intra-orally or through a midline lip-split incision for our study.

Patients with cancer other than that of buccal mucosa or tongue, history of previous neck surgery, recurrent cancer, significant cheek skin involvement, those whose surgery involved an angle-split incision and patients undergoing mandibulectomy were excluded for the study.

Fifty-six (56) patients were included for the purpose of this study. We documented the age, sex, site of primary-buccal mucosa or tongue, neck dissection unilateral or bilateral, clinical N stage, method of marginal mandibular nerve dissection- conventional method or direct visualization and dissection method and operating time for neck dissection.

The marginal mandibular nerve was dissected via two techniques. In the conventional approach, the facial vein was ligated near the inferior border of the submandibular gland and was reflected off superiorly, with the idea that the nerve will be reflected off the field along with the vein. This is the Hayes Martin method. In some cases, the fascia over the submandibular gland was incised and dissection was carried on between the gland and the fascia, lifting the fascia off the gland - the so-called sandwich technique. The nerve which lies in the overlying fascia is thus believed to be protected from injury.

Fig. 1. The marginal mandibular nerve (pointed to by the forceps) demonstrated by the direct visualisation and dissection method at the gonion.

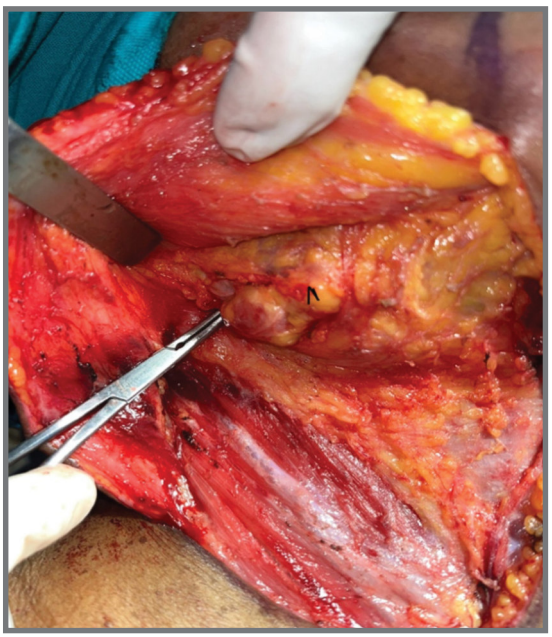

Fig. 2. A perifacial node (black arrowhead) in the vicinity of the marginal mandibular nerve. Only direct visualisation and dissection of the nerve can effectively clear these nodes.

From May 2024 onwards, we abandoned the aforementioned techniques and tried to directly look for the mandibular nerve and dissect it off the operating field. We call it the direct visualization and dissection method (figures1 and 2).

In this method, first the inferior border of the submandibular gland is identified and pulled inferiorly by a Babcock's forceps, thereby stretching the fascia over the gland near the inferior border of the mandible. We locate the gonion as an anatomical landmark and carefully look for the nerve which usually lies within 1 cm superior or inferior to the gonion. Once the nerve is identified, careful dissection of the nerve is carried out from the gonion posteriorly to above the inferior border of the mandible anteriorly and the nerve is mobilized superiorly to keep it off the operating field. We avoid the use of monopolar diathermy in the vicinity of the nerve. Minute bleeding is controlled with the judicious use of bipolar diathermy under copious irrigation.

We assessed for marginal mandibular nerve palsy on the first post-operative office visit. Marginal mandibular nerve palsy was said to be present if the patient had a facial asymmetry, particularly on smiling or showing teeth.

We measured outcomes on the basis of presence or absence of clinical evidence of marginal mandibular nerve palsy at first post-operative office visit, level 1b nodal yield in the final histopathology and operating time for neck dissection.

Statistical analyses: All statistical tests were carried out using IBM SPSS Statistics, version 26. D escriptive statistics were employed for the demographic parameters. Independent samples T-Test was used for comparing means between groups. Chi square test for independence was used for comparing frequencies between groups of categorical variables. Level of significance was set to less than 0.05.

Results

45 patients, undergoing 56 neck dissections, were included in the study. There were 30 males and 15 females in the study population (male=66.6%, females 33.3%). Age of the patients ranged from 37 years to 67 years (mean age=50.714 years, SD 8.184). 34 patients underwent unilateral neck dissections, and 11 patients underwent bilateral neck dissections. Table 1 represents the demographic characteristics of the patients along with other findings. 34 patients (75.55%) had cancer of the buccal mucosa and 11 patients (24.44%) had cancer of the oral tongue (table 2). The nodal status of the included patients is presented in table 3.

Table I: Patient demographics and operative findings

MEAN AGE IN YEARS (RANGE)	50.714 (37-67)
Sex, n (%)	
male	**30 (66.6%)**
female	**15 (33.3%)**
Neck dissection, n (%)	
unilateral	**34 (75.5%)**
bilateral	**11 (24.4%)**
Site of primary, n (%)	
Buccal mucosa	**34 (75.5%)**
Tongue	**11(24.4.%)**
Operating time	
Group 1, mean (SD)	**72.41 (11.164)**
Group 2, mean (SD)	**77.41 (9.866)**
Level 1b Nodal yield	
Group 1, mean (SD)	**2.409 (0.959)**
Group 2, mean (SD)	**3.265 (1.421)**

Table II: Site of primary distributed by sex

	BUCCAL MUCOSA PRIMARY	TONGUE PRIMARY	TOTAL
male	**22**	**12**	**34**
female	**08**	**03**	**11**
total	**30**	**15**	**45**

Table III: Nodal status of patients

NODAL STATUS	NUMBER	PERCENTAGE
N0	23	41%
N1	16	28.5%
N2a	02	3.5%
N2b	07	12.5%
N2c	08	14.3%
Total	56	100%

The marginal mandibular nerve was addressed conventionally in 22 necks, while in the rest 34 necks, direct visualization and dissection of the nerve was performed. In the conventional dissection group, 14 of 22 patients had post-operative marginal mandibular nerve palsy (63.63%). In the direct visualization group, 10 of 34 patients had marginal mandibular nerve palsy in the post-operative period (29.41%). There was a statistically significant difference in incidence of nerve palsy between the two groups (S«^{2} = 6.389, df=1, p= 0.011).

The mean level 1b nodal yield per neck in the conventional group was 2.409 +/- 0.959 (range 1-4), while that in the direct visualization and dissection group was 3.265 +/- 1.421(range 1-6) (table 1). There was a statistically significant difference in the level 1b nodal yield between the two groups (t= -2.479, df=54, p=0.016).

The mean operating time in the conventional surgery group was 72.41min (SD 11.164), and in the direct dissection group was 77.41 min (SD 9.866), as shown in table 1. There was no statistically significant difference in neck dissection operating time between the two groups (t= -1.760, df 54, p= 0.084).

Discussion

Neck dissection is an integral part of surgery for oral squamous cell cancers (OSCC). Current evidence is strongly in favor of neck dissection even in cases of clinically node negative necks.[1] As defined by the American Academy for Otolaryngology- Head and Neck Surgery (AAO-HNS), neck dissections are classified according to nodal levels dissected, with selective neck dissection (levels I-III/IV) being the standard of care for clinically node negative OSCC.[2]

The marginal mandibular nerve (MMN) is a branch of facial nerve that exits from the antero-inferior border of the parotid gland. It courses deep to the investing layer of deep fascia running across the lower border of mandible and the facial vessels. Dingman and Grabb.[3] in their seminal paper of about 100 cadaveric dissections, are of the view that the relatively higher incidence of injury to this branch of the facial nerve is due to lack of an accurate description of its course, and due to lack of anastomosis with other facial nerve branches in its distribution. In their study, they found out that regarding the part of the nerve posterior to the facial artery, in 81% of cases, the nerve passed above the inferior border of the mandible, and in the rest 19%, it was found less than 1cm below the angle of the mandible. The part of the nerve anterior to the facial artery was above the inferior border of the mandible in 100% cases. They also found out that in 98% cases, the nerve crosses superficial to the facial vein and artery. Of note, a constant lymph node was found at the anterior angle of the facial artery where it crosses the inferior mandibular border. In 5% cases, there was an anastomosis between the marginal mandibular branch and the buccal branch.[3] Also, they reported that the nerve usually has two or more branches, most commonly two (67%), followed by a single branch (21%). Multiple branching of the nerve has also been reported by several other authors. Balagopal et al[4] reported 79.7% patients having a single division, 12.9% patients having two divisions and 6.9% patients having three or more divisions. According to Batra et al,[5] the branches are more at the terminal course of the nerve than at the origin.

In a study of 133 neck dissections, Nason et al[6] reported transient MMN palsy in 28% of patients and persistent palsy in 16%. Temporary dysfunction of the nerve was resolved in 3-6 months. Importantly, visualization of the nerve did not affect outcome, which was not the case in our study.[6] Moller et al[7] reported an incidence of 14% of nerve palsy in patients undergoing

neck dissection for oral cancer, 2 weeks after surgery, and a permanent palsy in 4-7% cases 1-2 years after the operation. Hsu et al [8] reported an incidence of 33.3% of MMN palsy in their series of minimally invasive neck dissection.

In 1951, Hayes Martin et al[9] described their classical technique of preservation of the MMN during operations on the neck. This eponymous technique entails ligation and division of the facial vein deep to the deep cervical fascia and lifting the vein along with the upper skin flap, with the idea that the nerve will lie between the vessel and the skin flap and will thus be protected from injury. Kudva et al[10] reported the so-called sandwich technique where the flap is raised off the surface of the submandibular gland taking the MMN along with it. Another technique is to ligate the facial vessels keeping a long suture end. A snap is attached to the cut end and flipped cranially, which forms a loop of the vessel around the nerve and protects it from injury.[11]

However, these traditional and indirect techniques have an obvious downside in that the surgeon may miss a number of prefacial or perifacial nodes in the vicinity of the MMN, if the MMN is not dissected off completely from the operating field. Lim et al[12,13] reported an incidence of 35% of perifacial lymph node positivity in oral cavity carcinoma. More importantly, the occult perifacial nodal positivity in their series of oral carcinoma was 27%. In this paper they defined the perifacial lymph nodes as the nodal pads that lie anterior or posterior to the anterior facial vein on top of the facial artery in the submandibular triangle. Riffat et al[14] reported that the Hayes Martin method of preservation of the MMN was oncologically safe, but this study consisted of patients of oropharyngeal carcinoma only and not oral cancers, which are known to behave differently as far as nodal metastasis is concerned. On the other hand, Tirelli et al,[15] in their prospective study on 62 patients undergoing neck dissection, perifacial nodes were identified in 84% cases, their numbers ranging from 0 to 5. Anterior perifacial nodes were found to be in direct contact with the MMN, and the Hayes Martin method failed to address all perifacial lymph nodes in 59% cases.

The main limitation of our study was the small sample size of 45 patients (56 neck dissections). This is a hindrance in drawing concrete conclusions from the study. Also, since it is a retrospective review, it lacks adequate power and level of evidence.

Conclusion

Traditional methods of marginal mandibular nerve preservation are inadequate in preventing nerve palsy and its attendant morbidities, as well as adequately clearing the perifacial nodes in the level 1B region of the neck during neck dissection surgery. Needless to say, more well designed and high powered studies are required to draw concrete conclusion about the functional and oncological results of direct nerve visualization and dissection in neck dissection.

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Clinico-audiometric Features and Role of Steroids in Acute Acoustic Trauma

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ABSTRACT

Introduction

Acute acoustic trauma implies injury to ear due to explosive blast or impulse noise. It primarily results in sensorineural hearing loss, but also causes tinnitus, earache, ear fullness, unsteadiness or sleep disturbance etc. There is no gold standard treatment protocol which has been found to be convincing. This study was done to compare clinic-audiological recovery in early and late cases following oral steroid therapy.

Materials and Methods

A prospective study was conducted with 40 patients of 18 to 45 years of age suffering from Acute acoustic trauma. Patients reporting within 7 days were considered 'early cases' (Group A) and those reporting between 8th to 28th day were considered 'late cases' (Group B). Following thorough clinical examination, hearing thresholds were recorded before and after treatment with oral prednisolone instituted at 1mg/kg body weight for 7 days tapering over next 7 days. Follow-up audiograms were done on 15th day and 6 months later.

Results

Tinnitus, hearing loss, earache, unsteadiness and tympanic membrane perforation were found in 95%, 90%, 60%, 15% and 30% patients respectively. Majority audiogram showed Type II pattern with high frequency loss. Only 5.26% showed dip at 4kHz. Steroid therapy significantly improved air and bone conduction thresholds in both groups, however, inter-group comparison was not significant. Moreover, early reporters showed significantly better resolution of associated autological features than late reporters.

Conclusion

Study results underline beneficial effect of oral corticosteroids in the treatment of early as well as late presentation of Acute acoustic trauma.

Keywords

Acute Acoustic Trauma; Hearing Loss; Tinnitus; Audiogram; Thresholds; Steroid

Noise is acoustically made up of numerous sound waves with anarchically distributed amplitude and phase ratios, causing an unpleasant sensation.[1] Ear is most vulnerable organ to incur injury from blast pressure wave. If the ear is exposed to blast noise, at a sound intensity of 120 dB or higher, there is risk of acoustic trauma resulting in damage to sensitive structures of middle and inner ear. Clinically, the important consequence of loud noise is unilateral or bilateral hearing loss with tinnitus and earache. A reversible elevation of auditory thresholds produced by noise exposure is known as Temporary threshold shift, which spontaneously improves in a few days. An irreversible elevation of auditory threshold is associated with permanent pathological changes in cochlea known as Permanent threshold shift, in which hearing does not return to normal.

The term, acute acoustic trauma (AAT), is often used to encompass injury to the ear due to explosive blast or due to impulse noise. Explosive blast injury refers to otological trauma due to detonation of explosives. Impulse noise may be defined as a single-pulse sound or a burst of sound with a duration of between 0.001 second and

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01 second, typically equal to or greater than 140dB, which rapidly rises to a sharp peak and then quickly fades.[2]

Majority of research has been limited to the sensorineural hearing loss (SNHL) and its recovery pattern. The otological features, other than hearing loss, seem to have seldom gained place in the available scientific literature. There is no gold standard or established protocol of treatment of AAT because the evidence regarding the effectiveness of such treatments is not particularly convincing. A study was, hence done in a tertiary care hospital of Indian Army with the objectives to study the clinical features, to compare the baseline audiological findings with subsequent alteration in thresholds on 15th day after steroid treatment and at the end of 6th months in early and late cases of AAT.

Materials and Methods

A prospective cohort study was conducted over 18 months with 40 patients of AAT in the age group of 18 to 45 years. Patients were categorized, randomly in two grouped, based on day of reporting following AAT. Patients reporting within 7 days were considered 'early cases' and kept in Group A and those reporting between 8th to 28th day were considered 'late cases' and kept in Group B. Patients presenting after 28 days or already on treatment or those with noise induced hearing loss other than acoustic trauma as well as the individuals with diabetes and cardiovascular morbidity were excluded from the study. Approval for the study was obtained from Institutional Ethics Committee. Written consent was taken from each patient prior to inclusion in the study. Detailed clinical history was recorded for each patient with emphasis on age, gender, profession, date of acoustic trauma and otological symptoms.

A thorough clinical ear, nose, throat (ENT) examination was done. Hearing thresholds were recorded by modified Hughson-Westlake method on Hortmann Audio master PA444 audiometer in the frequencies 0.5kHz, 1kHz, 1.5 kHz, 2 kHz, 4 kHz, 6 kHz and 8kHz for air and bone conduction in both ears. Pure Tone Audiogram (PTA) was done before and after the treatment with oral steroids. Average of four frequencies at 500Hz, 1kHz, 2 kHz, 4 kHz was considered as Air conduction (AC) and Bone conduction (BC) threshold. First PTA was done at the time of reporting, before starting oral steroid. Each patient was treated with oral prednisolone 1mg/kg body weight for 7 days tapering over next 7 days. Thereafter, PTA was repeated on 15th day (after tapering off steroid) and again at the end of 6 months during follow-up to compare them with the first PTA.

Data was summarized as Mean ± SE (standard error of the mean). Groups were compared by Student's t test and also by repeated measures two factor (groups x periods) analysis of variance. Significance of mean difference within (intra) and between (inter) the groups was done by Newman-Keuls post hoc test after ascertaining normality by Shapiro-Wilk's test and homogeneity of variance between groups by Levene's test. Categorical groups were compared by chi-square (χ^2) test. A two-tailed (α=2) p-value <0.05 was considered statistically significant. Analyses were done on SPSS software (Windows version 17.0).

Results

The present study evaluates clinical features, audiological findings and role of steroids in early and late cases of AAT. 40 patients, 21 of them reporting early (Group A, n =21) and 19 of them reporting late (Group B, n=19) were recruited. The age of patients in Group A and Group B ranged from 19-42 yrs and 22-45 yrs respectively with mean (± SE) being 31.19±1.73 yrs and 33.68±1.65 yrs respectively, and median 32 yrs and 34 yrs respectively. The mean age of Group B was slightly higher than Group A, however the difference was not statistically significant. There was male predominance with higher being in Group A, yet the difference was not statistically significant. Similarly, majority of patients were serving soldiers with sudden intense noise of firing being the mechanism of acoustic trauma, however the difference was not statistically significant. Thus, the comparisons in Table I concluded that the subjects of two groups were demographically matched and comparable and thus did not influence the study outcome measures. Age of two groups was compared by Student's t test whereas sex, occupation and mode of trauma were compared by χ^2 test.

Table I: Demographic characteristics of study subjects

VARIABLE		GROUP A (n=21)	GROUP B (n=19)	STUDENT-T TEST/ χ^2 VALUE	p VALUE
Age	Mean age	31.19 ± 1.73	33.68 ± 1.65	1.04	0.306
Gender	Male	20 (95.2%)	17 (89.5%)	0.48	0.489
	Female	01 (4.8%)	02 (10.55)		
Occupation	Veteran	01 (4.8%)	0 (0.0%)	6.95	0.326
	Farmer	0 (0.0%)	01 (5.3%)		
	House wife	0 (0.0%)	02 (10.5%)		
	Medical resident	01 (4.8%)	0 (0.0%)		
	Recruit	01 (4.8%)	0 (0.0%)		
	Serving soldier	17 (81.0%)	16 (84.2%)		
	Student	01 (4.8%)	0 (0.0%)		
Mode of trauma	Firing	19 (90.5%)	16 (84.2%)	0.36	0.550
	Noise exposure	02 (9.5%)	03 (15.8%)		

Tinnitus was complained by all the 21 patients in Group A, and by 17 patients (89.5%) cases in Group B. Hearing loss was present in 19 (90.5%) and 17 (89.5%) cases respectively in Group A and Group B whereas earache was present in 16 (76.2%) and 8 (42.1%) cases respectively (Fig 1). The comparison of chief complains in two study groups showed a statistically significant difference with respect to earache as evident by x^2 =4.83 and p value 0.028, whereas the difference was found not significant in tinnitus or hearing loss.

Comparison of the associated features such as dizziness, headache, poor concentration sleep disturbance and past history of tinnitus between the two groups at the time of presentation showed that the differences were not statistically significant (Fig. 2).

Both ears were affected in majority of the patients. 38.1% and 21.1% cases suffered from tympanic membrane (TM) perforation and ear bleed in Group A and Group B respectively. Majority also suffered SNHL. However, difference of these variables in the two groups were not found significant (Table II).

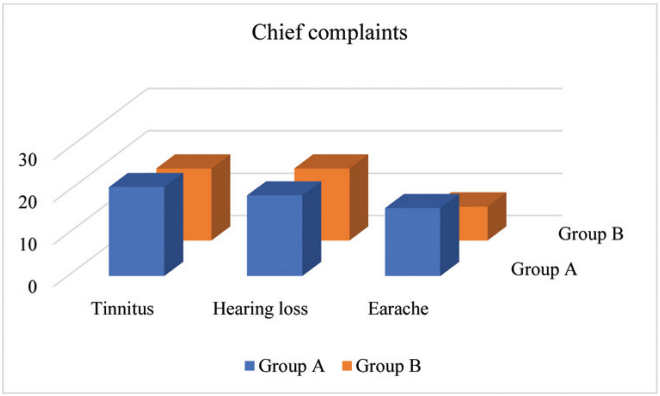

Fig. 1. Distribution of chief complaints

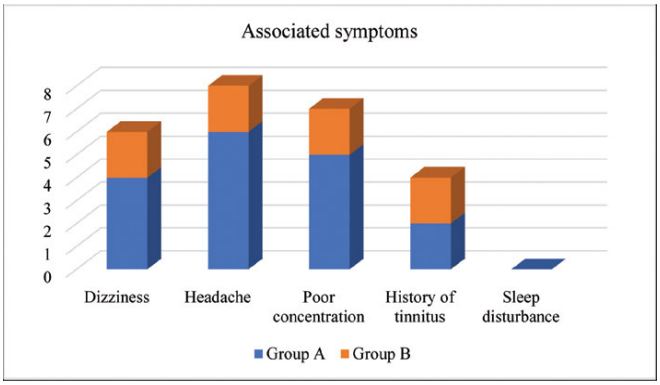

Fig. 2. Distribution of associated symptoms

Table II: Distribution of ear findings

VARIABLE		GROUP A (n=21)	GROUP B (n=19)	χ^2 VALUE	p VALUE
Laterality of ear	Bilateral	10 (47.6%)	11 (57.9%)	0.46	0.795
	Left ear	05 (23.8%)	04 (21.1%)		
	Right ear	06 (28.6%)	04 (21.1%)		
Otoscopy	Ear bleed	08 (38.1%)	04 (21.1%)	1.38	0.240
	TM perforation	08 (38.1%)	04 (21.1%)		
Hearing loss	No hearing loss	0 (0.0%)	02 (10.5%)	5.66	0.059
	CHL	08 (38.1%)	02 (10.5%)		
	SNHL	13 (61.9%)	15 (78.9%)		

First audiogram was done on the day of presentation in all the 40 patients. However, one patient in each group was lost to follow, hence excluded from the analysis leaving 20 patients in Group A and 18 patients in Group B for the analysis of results.

Mean AC threshold in left ear decreased with time in both study groups and the improvement over 6 months was proportionally higher in Group A as compared to Group B. Moreover, the mean AC threshold in left ear of Group B was comparatively higher than Group A on all occasions. Mean BC threshold in left ear decreased with time in Group A but it remained static in Group B in the PTA done on Day 15 and 6 months later, and the improvement over 6 months was proportionally higher in Group B as compared to Group A. Moreover, the mean BC threshold in left ear of Group B was comparatively higher than Group A on all occasions (Table III).

Table III: Mean AC and BC thresholds on different days in both study groups

LATERALITY	THRESHOLDS IN dB	GROUP A (n=20)			GROUP B (n=18)		
		DAY 1	DAY 15	6 MONTHS LATER	DAY 1	DAY 15	6 MONTHS LATER
Left ear	AC threshold	35.30 ± 2.56	27.50 ± 1.91	27.10 ± 1.80	45.33 ± 4.08	41.00 ± 3.75	40.67 ± 3.77
	BC threshold	25.15 ± 2.21	21.30 ± 1.74	21.10 ± 1.74	34.33 ± 3.33	28.00 ± 2.42	28.00 ± 2.42
Right ear	AC threshold	35.80 ± 2.53	26.30 ± 1.84	26.50 ± 1.57	37.89 ± 2.64	30.78 ± 2.22	30.78 ± 2.22
	BC threshold	24.10 ± 2.10	21.00 ± 1.79	21.10 ± 1.67	28.89 ± 2.79	25.33 ± 2.25	25.11 ± 2.24

Table III also shows that mean AC threshold in right ear decreased with time in both study groups and the improvement over 6 months was proportionally higher in Group A than Group B, though a slight elevation in threshold was observed in Group A at 6 months as compared to day 15. Whereas in Group B, it remained unchanged during that period. Moreover, mean AC threshold in right ear of Group B was comparatively higher than Group A on all occasions. Mean BC threshold in right ear decreased with time in Group B but a slight elevation in threshold was observed in Group A at 6 months as compared to day 15. The improvement over 6 months was similar in both the groups. Moreover, mean BC threshold in right ear of Group B was comparatively higher than Group A on all occasions.

Using Newman-Keuls test, it was found that the

differences of mean AC threshold in both the ears between Day 15 and 6 months later as compared to Day 1 were statistically significant (p-value <0.05) in both groups. However, the differences between Day 15 vs 6 months later were statistically not significant (p-value >0.05) in either group (Table 6). While analysing the BC thresholds, it was found that the differences of mean BC threshold in both the ears on Day 15 and 6 months later as compared to Day 1 were statistically significant (p-value <0.05) in both the study groups. However, the differences between Day 15 vs 6 months later were statistically not significant (p-value >0.05) in either of the study groups (Table IV).

Table IV: Mean difference in AC and BC thresholds over the study period in both groups

SIDE	MEAN dB THRESHOLDS	DAYS OF PTA	GROUP A (n=20)		GROUP B (n=18)	
			MEAN DIFFERENCE	p-VALUE	MEAN DIFFERENCE	p-VALUE
Left ear	AC thresholds	Day 1 vs Day 15	7.80 (22.1%)	<0.001	4.33 (9.6%)	0.001
		Day 1 vs 6 months later	8.20 (23.2%)	<0.001	4.67 (10.3%)	0.001
		Day 15 vs 6 months later	0.40 (1.5%)	0.751	0.33 (0.8%)	0.792
	BC thresholds	Day 1 vs Day 15	3.85 (15.3%)	0.003	6.33 (18.4%)	<0.001
		Day 1 vs 6 months later	4.05 (16.1%)	0.005	6.33 (18.4%)	<0.001
		Day 15 vs 6 months later	0.20 (0.9%)	0.872	0.00 (0.0%)	1.000
Right ear	AC thresholds	Day 1 vs Day 15	9.50 (26.5%)	<0.001	7.11 (18.8%)	<0.001
		Day 1 vs 6 months later	9.30 (26.0%)	<0.001	7.11 (18.8%)	<0.001
		Day 15 vs 6 months later	0.20 (0.8%)	0.879	0.00 (0.0%)	1.000
	BC thresholds	Day 1 vs Day 15	3.10 (12.9%)	0.006	3.56 (12.3%)	0.001
		Day 1 vs 6 months later	3.00 (12.4%)	0.003	3.78 (13.1%)	0.001
		Day 15 vs 6 months later	0.10 (0.5%)	0.919	0.22 (0.9%)	0.820

Similarly, using Newman-Keuls test, it was found that the differences of mean AC threshold in left ear between Group A and B on Day 15 and 6 months later were statistically significant (p-value <0.05). However, the difference on Day 1 was statistically not significant (p-value >0.05) (Table V). The difference of mean BC threshold in left ear between the two study groups on Day 1 was found statistically significant (p-value <0.05). However, the difference on Day 15 and 6 months later was statistically not significant (p-value >0.05). Similarly, the differences of mean AC or the BC thresholds in right ear between Group A and B on different days of audiometry were found statistically not significant (p-value >0.05) (Table V).

Table V: Comparison of difference of mean AC & BC thresholds between two groups

LATERALITY	THRESHOLDS IN dB	DAY OF AUDIOGRAM	COMPARISON BETWEEN GROUP A AND GROUP B	
			MEAN DIFFERENCE (%)	p-VALUE
Left ear	AC	Day 1	10.03 (22.1%)	0.106
		Day 15	13.50 (32.9%)	0.016
		6 months later	13.57 (33.4%)	0.015
	BC	Day 1	9.18 (26.7%)	0.038
		Day 15	6.70 (23.9%)	0.117
		6 months later	6.90 (24.6%)	0.242
Right ear	AC	Day 1	2.09 (5.5%)	0.503
		Day 15	4.48 (14.5%)	0.478
		6 months later	4.28 (13.9%)	0.174
	BC	Day 1	4.79 (16.6%)	0.402
		Day 15	4.33 (17.1%)	0.614
		6 months later	4.01 (16.0%)	0.392

Majority of audiogram did not have a dip in either ear in any of the groups under study, whereas 20% each in right and left ears in Group A and 22.2% and 33.3% in right and left ear respectively in Group B showed a dip at 4 kHz (Table VI). Analysis and comparison of the audiometric dips at different frequencies in the two ears in both groups showed that the result did not differ significantly.

Table VI: Comparison of the audiometric dips

LATERALITY	FREQUENCY	GROUP A (n=20)	GROUP B (n=18)	χ^2 VALUE	p-VALUE
Right ear	Dip at 3 kHz	04 (20%)	0 (0.0%)	5.91	0.116
	Dip at 4 kHz	04 (20%)	04 (22.2%)		
	Dip at 6 kHz	0 (0%)	02 (11.1%)		
	No dip	12 (60%)	12 (66.7%)		
Left ear	Dip at 3 kHz	02 (10%)	02 (11.1%)	2.48	0.478
	Dip at 4 kHz	04 (20%)	06 (33.3%)		
	Dip at 6 kHz	02 (10%)	0 (0.0%)		
	No dip	12 (60%)	10 (55.6%)		

Audiographic patterns were analysed in our study according to Song KT et al into four types. Type I showing a typical C5 dip hearing pattern, Type II showing normal hearing in the audible range, but an abrupt decrease in hearing level at high frequencies, Type III showing sloping from an audible range and deepening with higher frequencies and Type IV showing a decrease in hearing level at all frequencies.[3] 40% audiogram in Group A had

Type IV pattern, which was surprisingly absent in Group B. Type III pattern was comparatively higher in Group B. Group B also had two cases (11.1%) with Type I pattern in left ear. Comparing the pattern of audiograms of two groups, χ^2 test showed significantly different pattern between the two groups (χ^2=13.93, p-value 0.008) (Fig. 3).

Presenting symptoms and status of TM was followed up for 6 months. Resolution of these symptoms was analysed in both the study groups. TM perforation in 8 cases in Group A and 4 cases in Group B, associated with hearing loss and tinnitus, was found to heal spontaneously with resolution of symptoms in 6 cases in Group A; but was found unhealed with persistence of symptoms in all the 4 cases in Group B. Besides, the incidence of unresolved symptoms was 35.6% higher in Group B (55.6%) than Group A (20.0%). The difference was found to be significant (x^2=14.51, p-value 0.024) on comparing the symptom resolution between the two study groups (Fig. 4).

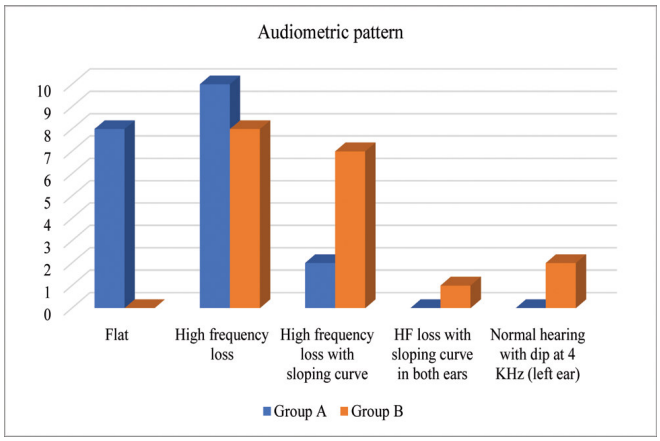

Fig. 3. Analysis of Audiometric pattern

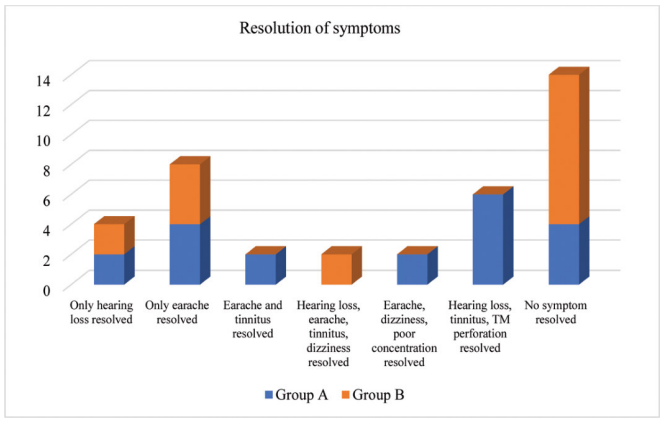

Fig. 4. Analysis of resolution of symptoms after 6 months

Discussion

Majority of the patients presenting with AAT in this study were the soldiers serving in Indian Army, who were exposed to the loud noise of firing a rifle of Indian Small Arms System (INSAS) during regular practice. Only few patients came with exposure to loud noise after bursting crackers on Diwali. Out of the total of 40 cases, 21 reporting within 7 days of acoustic trauma were placed in Group A and 19 reporting between 8th to 28th day of acoustic trauma were placed in Group B.

There were 37 males and 2 females with the average mean age of 32 years in this study where 82.5% of them were serving soldiers. Rezaee M et al. studied acoustic trauma in male military personnel in Tehran with the mean age of 20.08±2.61 years.[4] In a study involving 100 infantry soldiers, Munjal KR et al observed that the older infantrymen with longer military service had a longer recovery period and more incidence of permanent hearing loss owing to repeated impulse noise trauma of weapon firing.[5]

By definition, Acoustic trauma includes only one clinical feature, i.e. hearing loss. However, other subjective symptoms such as tinnitus, earache, ear fullness, unsteadiness or sleep disturbance etc are also not infrequent. Tinnitus and hearing loss have been reported as chief complaints by most of the scientific studies. In the present study, tinnitus, hearing loss, earache and unsteadiness were complained by 95%, 90%, 60% and 15% patients respectively. Lachaux J et al[6] in a retrospective study in 419 French soldiers reported tinnitus (87.4%) as the most frequent symptom followed by hypoacusis (35.1%) and earache (21.2%). Moon IS et al[7] evaluated 189 South Korean soldiers who had otologic symptoms after rifle shooting exercises without using any hearing protection and reported tinnitus in 94.2%, hearing impairment in 55%, ear fullness in 49.2%, headache in

38.1%, dizziness in 28%, and insomnia in 20.1% cases. On the contrary, Tazikei MH et al,[8] who reviewed the medical files of 256 war victims in Iran, reported aural symptoms in 55 of these subjects, out of which only 5.4% suffered from tinnitus.

Even a small-arm firing creates a blast wave containing both a blast wind and a shock wave resulting in overpressure at air-tissue interfaces. Though the estimated pressure of 08-56 kPa is required to rupture the human tympanic membrane, the damage has been reported by loud acoustic waves which barely create an overpressure of 0.3kPa.[2] In the present study, 30% cases suffered perforation of TM which is comparable to the reported incidence of 27.3% by Demiray E et al[9] but in contrast with the incidence of only 12.73% reported by Tazikei et al.[8]

The audiometric notch has long been recognised as a clinical sign of exposure to noise, and although the classic association is between continuous exposure to noise and a notch at 4 kHz, notches have been also been observed at 6 kHz in people exposed to impulse noise and at 3 kHz with low frequency noise.[10] Gravendeel and Plomp, in 1959, in a study of hundreds of soldiers exposed to light firearm, reported that the average place of the dips to be 5.9 kHz. They emphasized that although a 4 kHz notch might be found, the maximum loss might lie anywhere between 6 and 8 kHz.[11] This observation was also supported by Salmivalli who found the dip appearing at 5.5 kHz.[12] In our study, only 21.0% in right and 26.3% in left ears showed a dip at 4 kHz and the numbers did not differ significantly in either group under study.

Audiographic patterns were analysed according to Song KT et al into four types in our study. Type I showing a typical C5 dip hearing pattern, Type II showing normal hearing in the audible range, but an abrupt decrease in hearing level at high frequencies, Type III showing sloping from an audible range and deepening with higher frequencies and Type IV showing a decrease in hearing level at all frequencies.[3] Type I pattern was observed in 11.1% in Group B but not found in Group A. Type II pattern was observed in 50% in Group A and 44.4% in Group B. Type III pattern was observed in 10% in Group A and 38.9% in Group B. Type IV pattern was observed in 40% in Group A but not found in Group B. Using the same classification, Moon IS et al reported normal hearing in 18.5% of the cases, Type I in 21.8%, Type II in 40.3%, Type III in 18.5%, and Type IV in 0.9%.[7] In general, it is the Type I pattern which is usually seen in NIHL, however, in our study as well as in the study done by Moon IS et al[7] Type II hearing loss was more prevalent than Type I.

Acoustic trauma from gunshot results from high acoustic energy and pressure waves resulting in rupture of the organ of Corti, its separation from the basilar membrane and fracture and displacement of hair cell stereocilia. Therapeutic modalities aim to reduce the cellular hyperreaction, repair the impaired microcirculation and remove the metabolic byproducts of sensory cell damage. The modalities include systemic steroid, intratympanic steroid, antioxidants, microvasculature dilators, neurotrophins, vitamins, minerals, hyperbaric oxygen therapy (HBOT) or a therapeutic cocktail of these modalities. Steroids participate in forming ionic balance in the inner ear, stabilization of the cell membrane, and increased perfusion and inhibition of anti-inflammatory cytokines.[13] Administration of systemic with intratympanic steroid treatment has been claimed to result in better hearing outcomes than with systemic steroids alone[14]. Antioxidants like N-acetylcysteine with a total daily dose of 2700 mg, may be a safer alternative to steroids in countering free oxygen radicals and oxidative stress by providing 6-7% reduction in hearing threshold shift rate.[15] Neurotrophin-3 and brain derived neurotrophic factor promote the recovery of number of ribbon synapses as well as their function after noise induced trauma.[16] Magnesium by reducing apoptosis of hair cells by a decrease in calcium flow into the cell, reduces reactive oxygen species formation.[17] Oral Prednisolone 60 mg for 7 days plus daily sessions of HBOT for 10 days has been advocated by Bayoumy AB et al.[18]

In our study, the patients were treated with corticosteroids only. No other modality of treatment was applied to avoid any confounding synergistic beneficial effect. With oral prednisolone 1mg/kg body weight for 7 days tapering over next 7 days, it was observed that AC thresholds in left ear of patients of both study groups significantly improved (p value <0.05) on 15th day and

6 months later, compared to the thresholds on the 1st day. The difference between the two groups was also statistically significant (p value <0.05), thus suggesting a superior benefit of steroid therapy in improving AC thresholds of left ear in the patients who reported within 7 days of acoustic trauma. BC thresholds in left ear of patients of both study groups were found to have significantly improved (p value <0.05) on 15th day and 6 months later, compared to the thresholds on the 1st day. However, the difference between the two groups was not statistically significant (p value >0.05), thus suggesting no superior benefit of steroid therapy in improving BC thresholds of left ear in the patients of two groups. In the right ear of the patients of both the study groups, the AC as well as BC thresholds were found to have significantly improved (p value <0.05) on 15th day and 6 months later, compared to the thresholds on the 1st day. However, the difference between the two groups was not statistically significant (p value >0.05), thus suggesting no superior benefit of steroid therapy in improving AC or BC thresholds of right ear in the two groups.

Zloczower E et al published their study of 263 healthy military personnel presenting with AAT where 126 soldiers (48%) received no treatment and 137 (52%) received oral prednisolone in the dosage of 1mg/kg/day. Subjects in the steroids group demonstrated 13–14 dB average improvement in BC thresholds at 3 and 4 kHz (p value 0.001) and additional 7–8 dB average improvement in AC thresholds at 6 and 8 kHz, compared with the nontreatment group (p value < 0.0001). Subjects who were treated within 24 hours and those who initially presented with worse hearing losses (>35 dB) demonstrated significantly better hearing outcome.[19] Yehudai N et al published their study of 186 healthy soldiers presenting with AAT where 21 (23%) presenting within 7 days received oral prednisolone in the dosage of 1mg/kg/day for 7-10 days and 71 soldiers (77%) reporting a week after the trauma received no treatment. The mean BC improvements from the first to the last hearing test in the steroid-treated group were significantly higher (p value 0.01 for 0.5–4 kHz) than the mean reciprocal improvement in the nonsteroid group.[20]

Above two studies show significant improvement in AC and BC thresholds in AAT treated with oral steroids. Moreover, Zloczower E et al reported that the subjects who were treated within 24 hours demonstrated significantly better hearing outcome. Our study shows that steroid therapy did prove to be beneficial in improving AC and BC thresholds in both the study groups when pre-treatment threshold on the first day was compared with post-treatment thresholds on 15th day and 6 months later, but the improvement was not statistically significant when inter-group comparison was done.

Besides hearing loss, other features like earache, tinnitus, dizziness, poor concentration and TM perforation were found to resolve significantly better in Group A as compared to Group B suggesting that the cases of AAT reporting early respond better to steroid therapy.

Conclusion

AAT is a common consequence of exposure to high impulse noise occurring in soldiers in the training area or in combat. There is a hesitancy in wearing hearing protection devices among them, not only because of a perceived sense of machoism but also due to muffling of operational awareness during combat. There is lack of consensus on the current recommended treatment and no specific drug therapy has been proven to completely reverse the permanent threshold shift or to provide relief from other associated symptoms. Although further studies and larger sample of patients are required to draw firm conclusions, the results of our study do underline the beneficial effect of oral corticosteroids in the treatment of early and late presentation of ATT.

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Main Article

A Prospective Study on Effect of Reproductive Hormones on Obstructive Sleep Apnoea in Women

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ABSTRACT

Introduction

Obstructive sleep apnoea patients are more likely to develop certain metabolic and endocrine conditions. During pregnancy, progesterone is linked to hyperventilation. These findings imply that progesterone improves airways. An increase in stage N2 sleep seen in the Luteal phase maybe responsible due to Progesterone. An improvement in sleep is seen in postmenopausal women due to oestrogen as demonstrated in a study.

Materials and Methods

The study aims to correlate the levels of Oestrogen and Progesterone in Pre and Post menopausal women with OSA, performed in a tertiary care centre for a duration of 2 years, wherein the patients were divided into 2 groups and the STOP BANG score and Anthropometry and hormonal levels measured and correlated with appropriate statistical method.

Results

There was a statistically significant correlation between the mean weight, neck circumference, nasopharyngeal, oropharyngeal airway diameters and levels of Oestrogen and Progesterone.

Conclusion

It is their synergistic action of progesterone and oestrogen which is responsible for the definitive improvement in patients with symptoms of OSA as identified and demonstrated in the study.

Keywords

Obstructive Sleep Apnoea; Oestrogen levels; Progesterone levels; Pre and Post menopausal

About 4% of middle-aged men and 2% of women suffer from obstructive sleep apnoea (OSA), a disease marked by recurrent collapse of the upper respiratory tract during sleep. As the population ages and obesity rates rise, the disorder's prevalence is also rising. Obstructive sleep apnoea patients are more likely to develop certain metabolic and endocrine conditions, which can have major repercussions, such as a shortened life expectancy.[1] Breathing and sex hormones have an inverse effect. Progesterone, androgens, and oestrogens are all strongly suggested in the process, although it is unclear which hormone is most important. On the other hand, hormonal homeostasis is altered by sleep disorders like OSA.[2] During pregnancy, progesterone is linked to hyperventilation. According to Driver et al., women's upper respiratory tract resistance is lower during the luteal than follicular phases of the menstrual cycle.[3] These findings imply that progesterone improves airways. Sleep-related breathing difficulties are less common in postmenopausal women receiving oestrogen therapy than in women who have never had treatment. In patients receiving oestrogen-progesterone medication, the relationship is much more pronounced, suggesting that the hormones work in coordination.

More recently, studies were carried out on women

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who had gone through menopause as well as those who had not. In addition to SD, the investigators evaluated hormonal alterations in women with OSA. The FSFI score was lower in both groups than in the controls. Even after controlling for BMI, there was still a relationship between SD and OSA severity. Furthermore, there was a negative correlation between progesterone levels and FSFI scores in the premenopausal group. Severe OSA patients had lower levels of progesterone and oestradiol than controls. The scientists came to the conclusion that compared to healthy women, those with severe OSA have lower sexual function.[4] However, the hormonal condition of women was unaffected by either short-term or long-term CPAP therapy.[5]

Progesterone is a known GABA A receptor agonist.[6] An increase in stage N2 sleep seen in the Luteal phase maybe responsible due to Progesterone.[7,10] An improvement in sleep is seen in postmenopausal women due to oestrogen as demonstrated in a study.[8,9]

Progesterone increases the sensitivity of the respiratory centre to carbon dioxide, leading to hyperventilation and decreased arterial CO, levels. Hence during the luteal phase of the menstrual cycle the progesterone levels are elevated which cause an increase in minute ventilation and reduction in end-tidal CO.[14]

Oestrogen provides protection against Oxidative stress and upregulation of Hypoxic Inducible Factor 1 Alpha and hence decrease the Upper Airway Muscle Dysfunction; also, Oestrogen decreases chronic inflammation in upper airway tissues and decreases upper airway collapsibility associated with sleep apnoea. Oestrogen and progesterone improves the carotid body's ability to detect and respond to hypoxic conditions. Both hormones enhance genioglossus contractility through Oestrogen receptor α (ERα) pathways and also Oestrogen influences genioglossus muscle fibre composition, promoting Type I muscle fibres which are more fatigue-resistant.[15]

Materials and Methods

The study aims to correlate between the levels of Oestrogen and Progesterone levels in Pre and Post Menopausal women and Obstructive Sleep Apnoea.The study was done in a Tertiary Care centre wherein 40 subjects with symptoms of Obstructive Sleep Apnoea, 20 of whom were pre-menopausal and 20 of whom had attained menopause, post-menopausal. Patients presenting with symptoms of OSA to the OPD were considered for the study, appropriate history and examination were done following which patients giving consent for the study were taken as subjects. Those patients who had not consent for the study or not having any symptoms of OSA, diagnosed with endocrine disorders were excluded from the study. The pre-menopausal subjects were taken as Group A and post-menopausal subjects as Group B. The duration of study was from June 2023 to May 2025. Oestrogen and Progesterone levels are compared in Pre and Post Menopausal women with symptoms of Obstructive Sleep Apnoea and their BMI, Neck Circumference (measured at level of Laryngeal prominence/Adams Apple) and Anthropometry measures taken, X ray Nasopharynx and neck were taken for all subjects to measure Antero posterior diameters of Oropharyngeal and Nasopharyngeal Airways and correlated using STOP BANG Questionnaire (Scoring 1 for each of the following Loud Snoring, Often fatigue or sleepiness during the daytime, Observed to stop breathing during sleep, High Blood Pressure or current treatment on Hypertension, BMI - >35 kg/m^2, Age - >50 years, Neck Circumference - >40 cm, Male) and Apnoea Hypopnea index data obtained from sleep studies. Sleep studies (PolySomnography) were performed in the subjects of the study and their severity and symptoms of Obstructive Sleep Apnoea were correlated with their Body Mass Index and the levels of Oestradiol and Progesterone in Pre-menopausal and post-menopausal women.Apnoea Hypopnea Index (AHI)–measured in sleep studies conducted on all the subjects in the study.AHI <5 – Normal, AHI 5-14.9 – Mild Sleep Apnoea, AHI 15-29.9 – Moderate Sleep Apnoea, AHI ≥30 – Severe Sleep Apnoea.The data is categorized and appropriate statistical analysis done and results are obtained.

Results

The study was done on 40 subjects (20- premenopausal and 20- postmenopausal) and the appropriate anthropometric parameters compared and correlated with oestrogen and progesterone levels and results obtained.

Table I: Demographic details of age

GROUP	N	MINI-MUM	MAXI-MUM	MEAN	SD
Group A	20	33	39	35.7	1.9493
Group B	20	44	52	47.15	2.6611

Table II: Mean comparison of height and weight

PARAMETERS	GROUP	N	MEAN	SD	TEST STATISTIC	P VALUE
Height (ft)	Group A	20	5.4250	0.09105	-0.935	0.383
	Group B	20	5.4000	0.10260		
Weight (kg)	Group A	20	60.6000	7.21402	-5.176	<0.001*
	Group B	20	89.9000	5.44736		

Mann Whitney U test; pd≥0.05 considered statistically significant

The minimum age of the subjects in group A and B is 33 years and 44 years respectively and the maximum age is 39 years and 52 years respectively. Group A has a mean age of 35.7 and Group B has a mean age of 47.15.

The mean height (in feet) in Group A is 5.42ft and Group B is 5.40ft which did not show a significant statistical correlation, but the mean weight (in kg) which in Group A is 60.60kg and Group B is 89.90kg showed a significant statistical positive correlation.

Table III: Mean comparison of neck circumference

GROUP	N	MEAN (cm)	SD	t VALUE	P VALUE
Group A	20	31.9500	1.84890	–10.768	<0.001*
Group B	20	37.8000	1.57614		

Independent t-test; pd≥0.05 considered statistically significant

The neck circumference was measured at the level of Laryngeal prominence in the subjects using a measuring tape

The mean neck circumference in Group A is 31.95cm and in Group B is 37.80cm showed a statistically significant positive correlation with the symptoms and severity of OSA.

Table IV: Mean comparison of hormone level

PARA-METERS	GROUP	N	MEAN (pg/ml)	SD	TEST STATIS-TIC	P VALUE
Estradiol (pg/ml)	Group A	20	240.1250	191.53774	–5.410	<0.001*
	Group B	20	10.9610	5.43896		
Proges-terone (ng/ml)	Group A	20	7.8216	9.82813	–4.737	<0.001*
	Group B	20	0.1610	0.17038		

Mann Whitney U test; pd≥0.05 considered statistically significant

The mean levels of Oestradiol in Group A is 240.12pg/ml and in Group B is 10.96pg/ml showing a significant statistical positive correlation and the mean levels of Progesterone in Group A is 7.82ng/ml and Group B is 0.16ng/ml showing a statistically significant positive correlation suggesting both Oestradiol and Progesterone have an association with the symptoms and severity of OSA.

Table V: Mean comparison of airway parameters

PARAMETERS	GROUP	N	MEAN	SD	TEST STATISTIC	P VALUE
Nasopharyngeal (mm)	Group A	20	11.6200	1.84551	5.922	<0.001*
	Group B	20	7.9150	2.10270		
Oropharyngeal (mm)	Group A	20	10.2600	2.27813	-4.252	<0.001*
	Group B	20	6.8600	1.21759		

Nasopharyngeal - Independent t-test; pd≥0.05 considered statistically significant

Oropharyngeal - Mann Whitney U test; pd≥0.05 considered statistically significant

Nasopharyngeal airway and Oropharyngeal airway of subjects were measured using X ray cephalometry of subjects at the level of soft palate and hyoid bone.

The mean levels of Oropharyngeal and Nasopharyngeal airways are 11mm and 7.9mm in Group A, 10mm and 6.8mm in Group B respectively, with a negative correlation to the symptoms of OSA which are more in Group A subjects as compared to Group B subjects.

Table VI : Assesing Severity by using STOP BANG QUESTIONNAIRE

GROUP	MEAN STOP BANG SCORE
Group A (pre-menopausal)	4.2
Group B (post-menopausal)	6.6

Score <3 - Low risk of OSA
Score ≥3 - High risk of OSA

In our study the mean Stop Bang score of Group A (pre-menopausal) was around 4.2, mean Stop Bang score of Group B (post-menopausal) was around 6.6.

Among the 20 subjects in pre-menopausal group, 14 subjects had mild OSA with a Mean AHI of 8.6, 5 subjects had moderate OSA with a Mean AHI of 17.8, 1 subject had Severe OSA with a Mean AHI of 31.6.

Among the 20 subjects in post-menopausal group, 3 subjects had mild OSA with a Mean AHI of 12.8, 12 subjects had moderate OSA with a Mean AHI of 24.6, 5 subjects had severe OSA with a Mean AHI of 36.5.

The data shows a higher value of Mean AHI in Post-menopausal women when compared to pre-menopausal women in the study irrespective of the severity of OSA.

The values of Mean AHI when correlated with Mean levels of Oestradiol and Mean levels of Progesterone in both Pre-menopausal and in post-menopausal subjects with OSA shows a negative statistically significant correlation suggesting that severity of Obstructive Sleep Apnoea in the studied subjects is inversely proportional to the levels of Oestradiol and Progesterone.

Table VI: Severity of OSA and comparison of mean BMI and mean AHI in Pre-menopausal and post-menopausal women

	MILD OSA	MODERATE OSA	SEVERE OSA
Premenopausal women (Group A)	N = 14 Mean BMI = 21.8 Mean AHI = 8.6	N = 5 Mean BMI = 23.3 Mean AHI = 17.8	N = 1 Mean BMI = 32.4 Mean AHI = 31.6
Postmenopausal women (Group B)	N = 3 Mean BMI = 30.7 Mean AHI = 12.8	N = 12 Mean BMI = 33.4 Mean AHI = 24.6	N = 5 Mean BMI = 37.6 Mean AHI = 36.5

Table VII: Comparison of Mean AHI with levels of Oestradiol and Progesterone in Pre-menopausal and post-menopausal women

GROUP	MEAN AHI	MEAN LEVELS OF OESTRADIOL	MEAN LEVELS OF PROGESTERONE	STANDARD DEVIATION	CLINICAL SIGNIFICANCE
Premenopausal women	13.5	240.12pg/ml	7.82ng/ml	7.1	Mild OSA
Postmenopausal women	24.6	10.96pg/ml	0.16ng/ml	7.9	Moderate OSA

Discussion

The values showed a significant positive correlation between weight of the patient and symptoms of OSA, this is in correlation with study done by Carneiro-Barrera A et al.[12] Also, a similar significant negative correlation was obtained between the diameter of the nasal and oropharyngeal airway, neck circumference and symptoms of OSA and also its severity similar to study conducted by Pahkala R et al.[13] Similar results were seen in the study conducted by Sigurðardóttir ES et al[16] with regards to the levels of sex hormones and severity of AHI. A significant negative correlation was also found between the hormonal levels of progesterone, oestrogen and the anthropometric values and the symptoms of OSA suggesting that low levels of Oestrogen and Progesterone as seen in post-menopausal women is associated with an increase in the AHI levels, demonstrated in Sleep studies and hence an increase in the symptoms and severity of Obstructive Sleep Apnoea similar to studies conducted by Behan et al,[1] Stavaras C[4] and Sellix Et al.[7] A significant positive correlation is seen with Fattal D et al[17] study where BMI and Mean AHI scores are compared. Similar conclusion was made by Jehan S.et al[18] where they concluded that sleep pattern will be disturbed in post menopausal women due to hormonal deficiency and will increase the symptoms of OSA. In the study conducted by Wilhoit SC[19] et al, OSA in pre menopausal women is rare and symptoms of OSA in premenopausal is mainly due to individual anatomical variation of upper respiratory tract and obesity.In the study conducted by Qiu et al[20] a different mechanism was anticipated by which reductions in estrogen and/or progesterone hormones might cause instability in the ventilatory control system, leading to an overall increased risk for OSA and a degraded response to apneic events.Similar to our study this study also shows AHI is more in post menopausal women when compared to pre menopausal women. Similar results are seen in study conducted by Bixler et al [21] where the prevalence of sleep apnea was quite low in premenopausal women (0.6%) as well as postmenopausal women with hormone replacement therapy (HRT) (0.5%). Further, in these women the presence of sleep apnea appeared to be associated exclusively with obesity (BMI > or = 32.3 kg/m2).

Conclusion

The study conducted on 40 female subjects of which 20 were premenopausal and 20 postmenopausal suggest that Obstructive sleep apnoea is more in the post-menopausal group, a possible reason could be the deficiency of the hormones Oestrogen and Progesterone after attaining menopause. While both Oestrogen and progesterone tend to improve the sleep as demonstrated in the study wherein a decrease in both levels of Oestrogen and Progesterone increases the Apnoea-Hypopnea Index and also the symptoms and severity of OSA. The negative correlation between hormone levels and AHI severity confirms that higher estrogen and progesterone levels are protective against OSA development and progression.

Further Longitudinal studies and Randomized Control Trials with HRT, preferably with large sample size may help understand the relation between Oestrogen and Progesterone and its effects on decreasing the Severity of OSA and if possible understand the Genetics of the

hormonal influence and hence the different susceptibility of each individual to OSA.

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Comparison of Effectiveness of Homograft Septal Cartilage and Grommet as Partial Ossicular Replacement Prosthesis

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ABSTRACT

Introduction

Ossiculoplasty is the reconstruction of the middle ear ossicular chain. Hearing improvement largely depends on mechanical stability and bio-compatibility of prosthesis used.

Materials and Methods

This was a prospective study conducted on 62 Chronic Otitis Media (COM) patients who underwent type III tympanoplasty with ossiculoplasty. Patients in the age group of 18 years to 50 years and with conductive hearing loss of 45 dB to 60 dB with an air-bone (AB) gap of more than 45 dB, were included. Patients were randomly divided into two groups. Group A had ossiculoplasty with septal cartilage while Group B had it with grommet as the prosthesis. The outcome was measured using Pure Tone Audiometry (PTA), in terms of postoperative hearing gain and AB gap reduction at 3 months and 6 months.

Results

Mean age of the study population was 34.84±11.396 years, with male-to-female ratio 1: 1.07. Left ear was the most operated one. Major complaints were hearing loss and ear discharge. Squamosal disease was present in 62.9% of patients. Incus was the most involved ear ossicle. Mean PTA in both groups showed significant improvement when compared pre- and postoperatively. A comparison between the two study groups in terms of AB gap reduction and hearing gain pre- and postoperatively didn't reveal any statistically significant differences. Most common postoperative complication was secondary perforation. Extrusion was present in 3 patients of Group B.

Conclusion

Grommet can be an effective ossicular prosthesis with hearing outcomes and complications comparable to conventional grafts such as septal cartilage.

Keywords

Chronic Otitis Media; Ossiculoplasty; Septal Cartilage; Grommet; Partial Ossicular Replacement Prosthesis

Chronic Otitis Media (COM) is an inflammation of a part or whole of the middle ear cleft that is characterized by continuous or intermittent discharge through a persistent tympanic membrane perforation.[1] It remains a common cause of conductive hearing loss despite improvements in public health and medical care. The most frequent cause of mild to moderate hearing loss among children and young people in poor countries, as per WHO, is COM. The fact that chronic otitis media is a frequent cause of avoidable deafness makes it even more relevant.

According to WHO, a COM prevalence rate of more than 4% in a given community is a sign of a serious public health issue that has to be addressed right away.[2] COM is a persistent infection that can be seen in two forms. A central pars tensa rupture surrounded by residual tympanic membrane characterizes the tubotympanic variety of chronic otitis media, whereas the atticoantral variant affects the posterosuperior part of the middle ear cleft.

The conductive hearing loss in COM can be due to tympanic membrane perforation or ossicular disruption/

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disease. The most frequent ossicular defect found in both tubotympanic and atticoantral types of chronic otitis media is incudo-stapedial joint erosion with intact malleus. According to research by Austin, the malleus and stapes suprastructure are intact in roughly 60% of instances. Patients with ossicular erosion have a hearing loss of greater than 40 dB, according to a pure tone audiogram.[3]

Ossiculoplasty aims at reconstructing the ossicular chain after eliminating the middle ear disease to prevent recurrence. This is because, in more than 80% of the patients, the etiology for ossicular damage is COM with or without cholesteatoma.[4] Improvement in hearing after surgery can be assessed by pure tone audiometry (PTA).

The goal is now to achieve a post-operative middle ear status that is functionally very similar to the normal state and a near-normal neomembrane with a continuous ossicular chain. Surgery for chronic ear illness aims to cure the condition and rebuild the mechanism that transmits sound. The ossicular chain has been rebuilt using a variety of ossiculoplasty methods.

Even though PORP (Partial Ossicular Replacement Prosthesis) materials are widely accessible and produce better sound transmission, their cost has been a barrier to their use in ossiculoplasty.[5] When compared to other materials, a grommet can be an acceptable substitute for fulfilling this goal without compromising sound quality.[6] The optimal material for ossiculoplasty should be biocompatible, stable, safe, inexpensive, and readily available. For ossicular reconstruction, autografts, homografts, and synthetic prostheses can be adopted.

The purpose of our study was to evaluate the outcome of ossicular reconstruction for ossicular discontinuity using septal cartilage autografts and grommets and to compare their hearing results postoperatively using PTA.

Materials and Methods

After obtaining approval and clearance from the institutional ethics committee (ethics committee number) and informed written consent a prospective randomized control study was carried out, in the Department of ENT of a tertiary care teaching institute in Bangalore, from August 2022 to January 2024. A total of 62 participants between the ages of 18-50years were recruited. The inclusion criteria included patients of chronic otitis media with conductive hearing loss of 45 dB to 60 dB with an air-bone (AB) gap of more than 45 dB, and patients who underwent type III tympanoplasty with ossiculoplasty. Participants with other rare causes of conductive hearing loss were excluded from the study.

Patients were divided into two groups (Group A and Group B) randomly using a computer random sequence generator. Group A included the patients who underwent ossiculoplasty with homograft septal cartilage and Group B had patients of ossiculoplasty using a teflon grommet as the ossicular prosthesis. Postoperatively, sterile mastoid dressing was put after packing the external auditory canal with medicated gauze, which was removed after 1 week of surgery along with postaural sutures and EAC packs. Patients were kept under antibiotic coverage for at least 2 weeks, with weekly follow-up till 1 month. Postoperative PTA was done at 3 months and 6 months. The AB gap reduction on PTA postoperatively was graded as: none (< 5 dB), minimal (5-10 dB), satisfactory (10–15 dB) and good (>15 dB). Statistical Package for Social Sciences [SPSS] for Windows Version 22.0 Released 2013. Armonk, NY: IBM Corp., has been used to perform statistical analyses of the study results.

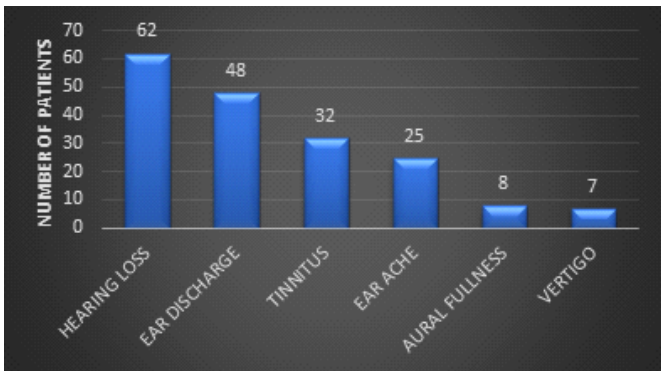
Results

The average age of the study population was 34.84±11.396 years. The maximum number of patients were in the age group of 46-50 years (18 patients), whereas the 26–35 years group had 17 patients (27.4%). There were 12 patients in the age group of 36–45 years, and 15 patients (24.2%) were between 18 and 25 years. The male-to-female ratio was 1: 1.07, with 30 men (48.4%) and 32 women (51.6%). Group A consisted of 18 men and 13 women, while Group B included 12 men and 19 women.

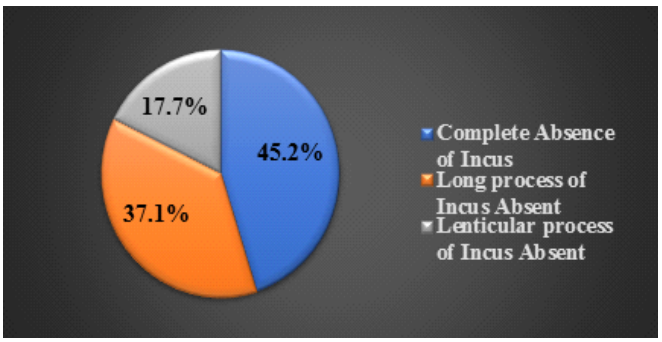
All our patients had hearing loss (100%). Ear discharge was present in 48 patients (77.4%), 32 patients (51.6%) had tinnitus, 25 patients (40.3%) had ear pain, 8 patients (12.9%) complained of aural fullness, and 7 patients (11.3%) experienced vertigo (Graph 1). Left ear was the

Table I: Statistical Analysis of PTA Improvement at 3 Months and 6 Months Postoperatively with Respect to Preoperative Values

GROUP		PTA	MEAN DIFF	SD DIFF	p-VALUE
GROUPA	Preoperative PTA	Postoperative PTA at 3 months	10.983	0.989	<0.001
		Postoperative PTA at 6 months	11.603	1.099	<0.001
	Postoperative PTA at 3 months	Postoperative PTA at 6 months	0.621	0.331	0.197
GROUP B	Preoperative PTA	Postoperative PTA at 3 months	9.733	1.442	<0.001
		Postoperative PTA at 6 months	10.600	1.600	<0.001
	Postoperative PTA at 3 months	Postoperative PTA at 6 months	0.867	0.459	0.208



Graph 1: Presenting Complaints



Graph 2 : Involvement of Incus

most operated one (54.8%). Squamosal disease with retraction pocket was present in 13 patients (21%), whereas 26 patients (41.9%) were without retraction pocket. Remaining 23 patients (37.1%) had mucosal type of COM.

Incus was the most involved ear ossicle (100%), followed by malleus (37%) and stapes (32.2%). Complete erosion of incus was observed in 28 patients (45.2%), 23 patients (37.1%) had an absent long process of incus, and rest of them (11 patients; 17.7%) had involvement of lenticular process of incus (Graph 2).

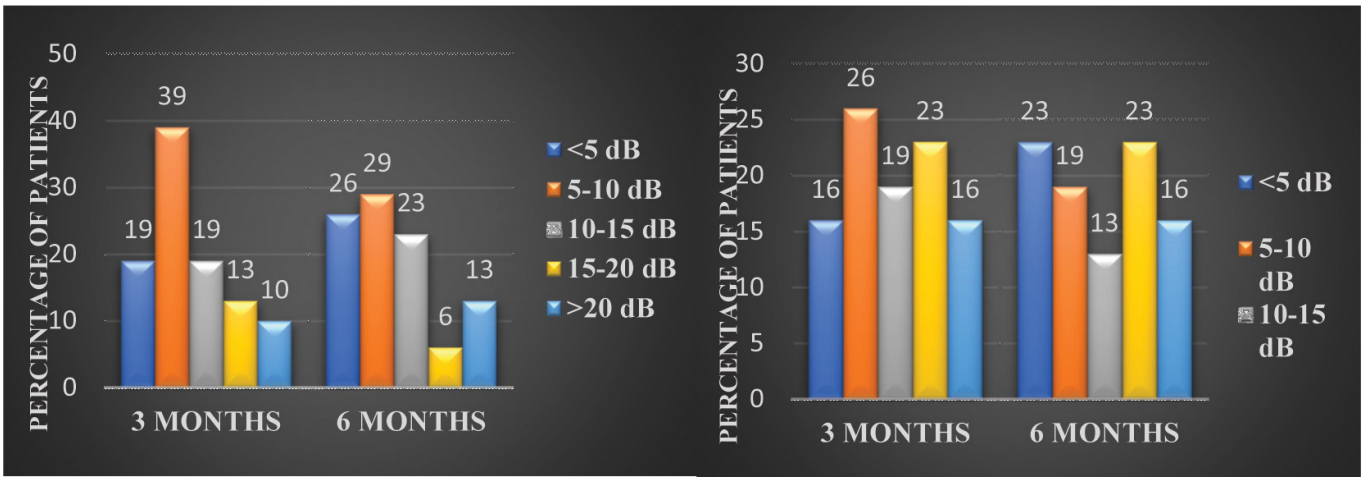
The mean PTA of the patients in Group A preoperatively was 58.60 ± 9.467 dB. Postoperatively, it was 48.87 ± 9.630 dB at 3 months, and 58.25 ± 9.442 dB at 6 months. The mean PTA of the patients in Group B was 58.25 ± 9.442 dB preoperatively. At 3 months follow-up, it was 45.93 ± 12.976 dB, and at 6 months, it was 45.57 ± 13.788 dB.

The comparison of the mean PTA at different time points (pre- and postoperatively at 3 and 6 months) in Group A and Group B was found to be statistically significant (p<0.001) (Table I). On postoperative evaluation, Group A had minimal AB gap reduction in most of the patients (39% of patients) and good AB gap reduction in 23% of the patients, at the end of 3 months. There were 6 patients each in <5 dB and 10-15 dB AB gap reduction categories. Group B had a good AB gap reduction in 39% of patients while 26% of patients had minimal reduction at 3 months postoperatively. Satisfactory outcome was observed in 19% of patients and 16% patients had <5 dB AB gap reduction (Table II).

At 6 months postoperatively, Group A had minimal

Table II : Postoperative AB Gap Reduction at 3 Months

AB GAP REDUCTION		GROUP A		GROUP B	
		NO OF PATIENTS	PERCENT (OUT OF 31)	NO OF PATIENTS	PERCENT (OUT OF 31)
AT 3 MONTHS	<5 dB (none)	6	19	5	16
	5-10 dB (minimal)	12	39	8	26
	10-15 dB (satisfactory)	6	19	6	19
	>15 dB (good)	7	23	12	39



Graph 3: Postoperative Hearing Gain in Group A and Group BB

Table III : Postoperative AB Gap Reduction at 6 Months

AB GAP REDUCTION		GROUP A		GROUP B	
		NO OF PATIENTS	PERCENT (OUT OF 31)	NO OF PATIENTS	PERCENT (OUT OF 31)
AT 6 MONTHS	<5 dB (none)	8	26	7	23
	5-10 dB (minimal)	9	29	6	19
	10-15 dB (satisfactory)	7	23	4	13
	>15 dB (good)	6	19	12	39
	Lost to follow-up	1	3	2	6

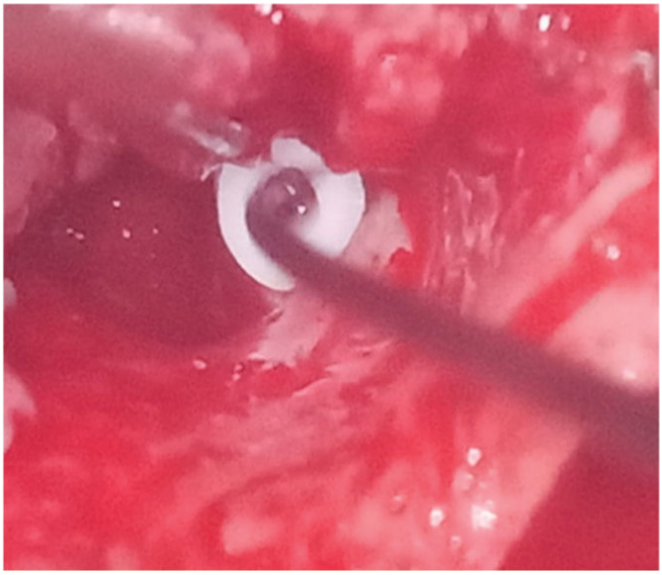


Fig. 1. Grommet Insertion over stapes head

Fig. 2. Grommet Extrusion into the External Auditory Canal

AB gap reduction in most of the patients (29% of patients) and <5 dB AB gap reduction in 26% of the patients. There were 6 patients in >15 dB and 7 patients in 10-15 dB AB gap reduction categories. In the follow-up, one patient of Group A was lost.In Group B, good AB gap reduction was seen in 39% of patients while 19% of patients had minimal reduction, at 6 months follow-up. Satisfactory outcome was present in 13% of patients whereas 23% of patients had <5 dB AB gap reduction, and 2 patients had missed their follow-up (Table III).

The AB gap reduction at 3 months and 6 months postoperatively in both the study groups were compared and was statistically insignificant with p-values of 0.721 and 0.392 respectively. This points out a similar outcome of ossiculoplasty in both study groups in terms of AB gap reduction.

In 3-month follow-up, >20 dB hearing gain was present in 3 patients of Group A and 5 patients of Group B. There were 4 patients of Group A and 7 patients of Group B with 15-20 dB hearing gain. Hearing gain of 10-15 dB was observed in 6 patients of each group.

Most of the patients had 5-10 dB hearing gain, in either of the groups. Group A had 6 and Group B had 5 patients with <5 dB hearing gain. Postoperative PTA at 6 months in Group A shows >20 dB hearing gain in 4 patients and 15-20 dB gain in 2 patients. Most of the patients (29%) had 5-10 dB hearing gain. There were 7 patients with 10-15 dB gain, and 8 patients with <5 dB gain.

In Group B, 23% of the patients fell into both <5 dB and 15-20 dB categories. A gain of 5-10 dB was observed in 6 patients, 10-15 dB in 4 patients and >20 dB in 5 patients. Postoperative hearing gain at three and six months, indicated no statistically significant difference between Group A and Group B (p-values of 0.675 and 0.392, respectively) (Graph 3).

The most common postoperative complication was secondary perforation (19.3% in group A and 22.5% in group B). Granulations were present in 5 patients of group B. There was persistent ear discharge in 3 patients of group A and 6 patients of group B. Postoperative earache was present in 3 patients of each group. Out of 62 patients who underwent surgery, only 3 patients of group B had extrusion while none of the group A patients had. This was observed in 6-month follow-up (Figure 2).

Discussion

Conductive hearing loss often arises from ossicular discontinuity. Ear surgery aims to restore hearing post-

disease eradication. Various materials can be used to achieve this ossicular continuity. An ideal graft should be readily available, affordable, durable, and produce good hearing outcomes with minimal extrusion, migration, or foreign body reactions. With numerous grafts and prostheses available, selecting the right one is challenging.

In our study, 62 patients meeting the inclusion criteria were enrolled, with a demographic picture similar to prior studies by Sharma et al.[7] and Khanam et al.[8] Patients were randomly assigned into two groups: Group A, which used refashioned septal cartilage, and Group B, which used a 0.9 mm grommet for ossicular reconstruction.

Participants were in the age group of 18 to 50 years, with an average age of 34.84 ± 11.396 years. The age group of 46-50 years had the highest number of patients (29%), followed by the 26-35 years group (27.4%). This distribution was consistent with studies by Lamba et al.,[9] Laha et al.,[10] and Lakshmipathiraju et al.,[11] where most patients were in their third or fourth decades of life. The study included 30 men (48.4%) and 32 women (51.6%), with a male-to-female ratio of 1:1.07, mirroring the gender distribution found in Sharma et al.[7] and Khanum et al.,[8] showing a slight female predominance. Most patients were from rural or lower-middle-class backgrounds, likely due to factors like overcrowding, poor hygiene, poverty, and limited access to healthcare, which are known risk factors for chronic otitis media (COM).[9]

Surgery was performed on the left ear in 54.8% of patients and on the right ear in 45.2%. This aligns with findings from Olowookere et al.[12] and Chavan et al.,[13] where the left ear was more affected, although Lamba et al.[16] found a higher prevalence of right ear involvement.

Hearing loss was the most common presentation (100%), followed by ear discharge (77.4%). Tinnitus, earache, auditory fullness, and vertigo were also reported. Consistent with Khanum et al.[8] and Sharma et al.,[7] all patients had hearing impairment. Most patients had squamosal type of COM, with or without a retraction pocket, similar to Khanum et al.[8]'s findings.

The incus was the most commonly affected ossicle (100%), followed by the malleus (37%) and stapes (32.2%). Erosion of the incus long process was the most prevalent, corroborating findings from Prakash et al.[6], Lakshmipathiraju et al.,[11] and other studies. The results were found to be better when only incus was eroded, middle ear mucosa was healthy, and in mucosal cases. Contrary to these observations, Laha et al.'s [10] results document incudo-stapedial joint and the lenticular process of incus as the common sites of ossicular discontinuity.

Granulations accounted for 72% of the primary disease in Lamba et al.[9] study, followed by cholesteatoma in 46% patients. Yorgancýlar et al.[14] and Zhu et al.[15] on the other hand, discovered cholesteatoma as the main disease contributing to ossicular erosions. Additionally, the work by Mahanty et al.[16] provides evidence supporting cholesteatoma as the predominant pathology. In our study, cholesteatoma was present in 29 individuals, while 47 patients had hypertrophied middle ear mucosa. No cases of COM complications were encountered.

The mean pure-tone audiometry (PTA) in Group A improved from 58.60 dB preoperatively to 48.87 dB at 3 months, while Group B improved from 58.25 dB to 45.93 dB. The mean PTA reduction at 6 months showed Group A at 58.25 dB and Group B at 45.57 dB. The differences were statistically significant ($p<0.001$), indicating both groups showed significant hearing improvement.

At 3 months, 39% of Group A and 23% of Group B had minimal AB gap reduction, with better results in Group B. At 6 months, Group B showed a good AB gap reduction in 39% of patients. There was no significant difference in hearing gain between the two groups.

Extrusion occurred in 3 patients from Group B and was observed in 6 months followup. The most common postoperative complication was secondary perforation (19.3% in Group A and 22.5% in Group B). Other issues included granulations, earache, and ear discharge. No graft extrusion was noted in Group A.

Middle ear adhesion formation after surgery can limit the success of ossicular reconstruction. This was limited by the removal of unhealthy mucosa and granulations in the middle ear cleft, and stabilizing the ossicular continuity with antibiotic- and steroid-soaked gel-foam.

Reconstruction of the ossicular chain is still a growing surgical specialty in otolaryngology. The purpose of

ossiculoplasty is to create a firm and consistent connection between the tympanic membrane and the mobile stapes footplate to provide optimum hearing results, while keeping the ear dry as well. A notable improvement in hearing was obtained with the use of a grommet as a PORP, in our study. Around the world, grommets have been standard equipment in otosurgeries for years. The substances utilized in the manufacturing of grommets has undergone the usual testing procedures for prostheses used in ossiculoplasty and has been certified for use in middle ear surgery.[5] Also, its biocompatible, mechanically stable, and cost-effective.

The surface of the grommet is extremely resistant to the development of biofilms and thereby reduces the chances of subsequent rejection. The extrusion rates attributed to the use of prostheses can be minimized by interpositioning a cartilage cap between the tympanic membrane graft and the prosthesis, as per Kumar.S et al.[4] The use of synthetic prostheses eliminates the chances of transmitting prions or harboring microscopic diseases as in preserved homografts. On the other hand, it can be vulnerable to immune-mediated rejection or foreign body reactions.

Reduction of operating time and surgical ease were another two advantages. Sculpturing the cartilage graft requires the skill and expertise of the surgeon. The time consumed in this refashioning of cartilage was saved with usage of grommet. The sound conduction via the restored ossicular chain depends greatly on the mass and stiffness of the prostheses. Zenner et al.[17] suggested a mass of less than 5mg to ensure maximum sound transmission. By virtue of its shape and size, grommets can be stably fixed over stapes head. Promising results were obtained with grommet ossiculoplasty, in terms of graft uptake, improvement of hearing, and patient satisfaction, when compared to cartilage ossiculoplasty.

Cartilage grafts have the disadvantage of complete reabsorption like the original ossicles if the infection persists/recurs. Negative middle ear pressure and tubal insufficiency can also lead to graft rejection.[6] Graft failure in natural or autologous grafts may be brought on by atrophy, revascularization of marrow spaces, refixation, or disease recurrence as a result of residual disease. For prolonged durations, autografts can keep their size, form, contour, and physical integrity; nevertheless, when middle ear suppuration occurs frequently, osteitis can cause resorption, which is comparable to what happens to ossicles in COM. Chavan R. P et al.[18] suggested that the chances of reabsorption can be minimalized by providing adequate freedom of movement to the ossicular chain, rather than snuggly fitting it under the tympano-meatal graft.

Considering the hearing outcome, AB gap reduction, and extrusion rate, both the groups in our study had no statistically significant difference. This concludes that grommet can be an effective alternative for the conventional prostheses of ossiculoplasty. Better understanding of middle ear mechanics and microscopic dimensions of middle ear pathologies in recent years has greatly influenced the success rates of ossicular reconstruction surgeries.

Conclusion

Chronic Otitis Media (COM) remains a major cause of conductive hearing loss, particularly in rural and low socioeconomic areas where medical care access and treatment costs are significant factors. This study included a balanced number of males and females, mostly in their third or fourth decade of life, many of whom had delayed medical treatment despite long-term hearing loss and ear discharge.

Ossicular chain restoration is crucial for functional recovery as per various studies comparing different ossiculoplasty materials. This research compared septal cartilage and grommet ossiculoplasty, finding both methods significantly improved hearing without a statistically significant difference between them. Grommets, while avoiding issues like reabsorption and graft sculpturing, may still face risks of extrusion and foreign body reactions. Despite these risks, grommets offer ease of use and time efficiency, making them a viable alternative to traditional materials without compromising the hearing gain. The study's sample size is limited, suggesting a need for larger, long-term trials to better evaluate the outcomes. However, our findings indicate that well-executed single-stage

ossiculoplasty can notably improve hearing and quality of life.

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Main Article

Endoscopic Tympanomeatal versus Push Through Technique : A Prospective Study

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ABSTRACT

Introduction

Tympanoplasty is a procedure aimed at eradicating middle ear disease, repairing a perforated tympanic membrane, and restoring hearing. Endoscopic tympanoplasty offers advantages such as a magnified view and avoidance of larger incisions, but is limited by being a single-handed technique with no depth perception. The two techniques compared were: Conventional Method: Involves an extended Rosen's incision and raising a Tympanomeatal flap to reach the middle ear. Push Through Technique: Involves no Tympanomeatal flap elevation; a cartilage graft is pushed through the tympanic membrane perforation after filling middle ear with antibiotic soaked gelfoams.

The study's aim was to study the difference between the two techniques in terms of operative time, post-operative pain, post-operative complications (granulation formation and canal stenosis) graft take rate, and hearing improvements.

Materials and Methods

This was a prospective comparative study of 50 patients undergoing Type I Endoscopic Tympanoplasty. Inclusion Criteria included patients with moderate and small perforations, Type I Tympanoplasty, and tuning fork test/Pure Tone Audiometry results coherent with the tympanic membrane defect. Exclusion Criteria included patients with a discharging ear, tympanoplasty other than Type I, and patients less than 18 years of age.

Results and Conclusion

The two techniques yielded similar results in terms of graft uptake rate and post-operative audiometry changes. The push through technique demonstrated clear advantages with less post-operative pain, no incidence of granulation tissue formation, and less operative and recovery time.

Keywords

Tympanoplasty; Tympanic Membrane; Prospective Study; Pure Tone Audiometry; Operative Time; Post-operative Pain; Granulations

Tympanoplasty is a surgical procedure for the middle ear that encompasses the eradication of disease, the repair of the perforated tympanic membrane, and the restoration of hearing. It can be performed through post aural, endaural, or trans canal approaches. Endoscopic tympanoplasty, a trans canal approach, provides a wider, closer, and magnified view of the fine structures of the middle ear and better visualization even in a tortuous external ear anatomy. Furthermore, it avoids larger incisions, leading to lesser post-operative pain, neuralgia, and earlier recovery.[1,2]

A key limitation of the endoscopic approach, however, is that it is a single-handed technique, and it lacks depth perception.[3]

This study focuses on comparing two techniques for endoscopic tympanoplasty: the conventional Tympanomeatal flap elevation method and the push through technique.

Endoscopic Tympanoplasty Techniques

1. Conventional Tympanomeatal Flap Elevation Method

This is the conventional method , which involves giving an extended rosen's incision and raising a Tympanomeatal flap to reach the middle ear cavity. This technique addresses all types of perforations, including large and

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marginal perforations. Disadvantages of this method includes more post-operative pain, longer operative and recovery time, and occasional canal narrowing.

2. Push Through Technique

The push through technique is typically done for small and moderate dry perforations where the Pure Tone Audiometry (PTA) is coherent with the size of the perforation and Otoscopy findings. The distinguishing feature is that there is No Tympanomeatal flap elevation. Instead, middle ear space is filled with antibiotic soaked gelfoams and cartilage graft is pushed through the tympanic membrane perforation into the middle ear space. This is a minimally invasive technique that offers a relatively low risk of complications, a shorter operative time and faster recovery.[4]

The push through technique is disadvantaged when dealing with large or marginal perforations as one need to have a significant remnant tympanic membrane.

Preparation of graft: In both techniques tragal cartilage was harvested, the thicker perichondrium was lifted off carefully, the thinner perichondrium was kept as it was, the island cartilage was thinned and prepared as per the size of perforation keeping about 1 mm thin perichondrium all around the cartilage making an island composite graft.

The aim of the study was to compare the difference between these two techniques in terms of:

- Operative time
- Post-operative pain
- Post-operative complications (Granulation formation and canal stenosis)
- Graft take rate
- Hearing improvement

in patients with inactive mucosal type of chronic otitis media between two techniques of endoscopic tympanoplasty i.e; conventional tymapnomeatal flap raising & push through technique.

Materials and Methods

This was a Prospective comparative analytical study of 14 months starting from January 2024 to February 2025 conducted in Department of ENT of Civil Hospital Ahmedabad. Patients attending E.N.T. OPD at tertiary care centre were included. The study was done after getting approval from our institutional scientific and ethical review board.

Fig. 1. Harvesting Tragal cartilage

Fig.2. Island cartilage graft

Inclusion criteria:

- All Patients presenting to ENT OPD with small and moderate central perforation.
- Type 1 tympanoplasty
- Tuning fork test with pure tone audiometry in coherence with tympanic membrane defect.

Exclusion criteria:

- Patients with discharging ear.
- Patients not willing to participate in the study.
- Tympanoplasty other than Type I.
- Patients not willing for follow up visits.
- Patients <18 years of age.

Detailed history was obtained from all the patients. After obtaining history, a detailed clinical examination including General Examination, Systemic Examination and E.N.T. examination was done.

All procedures were done under general anaesthesia. Tragal cartilage graft was prepared as mentioned earlier. Both procedures were done by one hand endoscopic method by an experienced single surgeon.

For both techniques margins were freshened. For conventional technique, extended rosen's incision was kept. Tympanomeatal flap was elevated. Middle ear was checked for any disease, adhesions and round window reflex. Middle ear was packed with antibiotic soaked gelfoams. Cartilage composite island graft was kept by underlay with perichondrium towards the middle ear. The perichondrium was kept over cartilage by underlay, tympanomeatal flap was reposited back and supported with antibiotic soaked gelfoams.

For push through technique the procedure was same as mentioned in conventional one with only difference that endomeatal incision was not kept. Tympanomeatal flap was not raised. Round window reflex, middle ear status was checked using straight and angled endoscopes.

Results

The study results comparing the two techniques are summarized below (refer to the Endoscopic Tympanoplasty via Tympanomeatal flap raising method as "Conventional" and Endoscopic Tympanoplasty via Push through technique as "Push Through"):

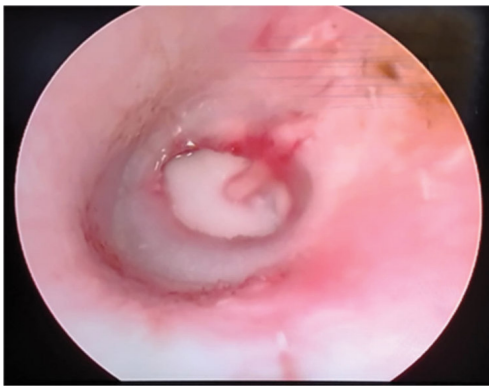

Fig. 3. Post-op picture of graft placed by push through technique

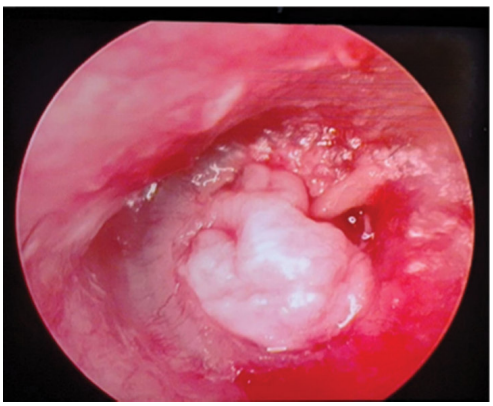

Fig. 4. Cartilage graft with second layer perichondrium as double breasting

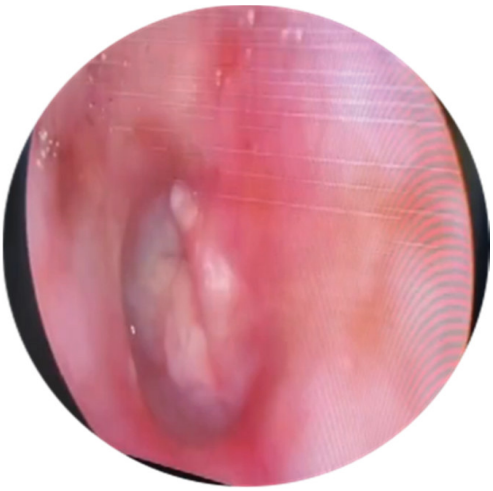

Fig. 5. Graft uptake at 6 months Post-op.

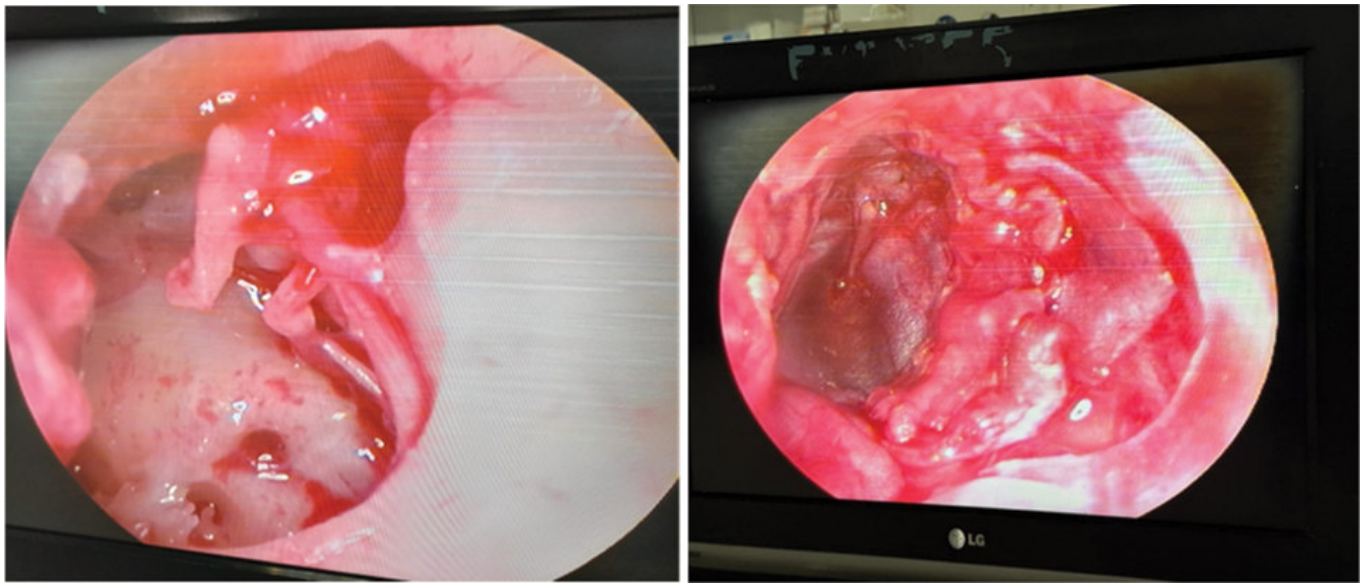

Fig. 6. TM Flap raising technique, before and after Graft placement.

Table I : Comparison of Endoscopic Conventional and Push through technique

PARAMETER	CONVENTIONAL (n = 24)	PUSH THROUGH (n = 26)	p-VALUE
Post-operative pain	22/24 (91.7%)	16/26 (61.5%)	0.0195
Granulations at 3 weeks	7/24 (29.2%)	1/26 (3.8%)	0.0106
Graft uptake at 3 weeks	19/24 (79.2%)	24/26 (92.3%)	0.0423
Hearing improvement at 3 months	20/24 (83.3%)	24/26 (92.3%)	0.0423
Graft uptake at 6 months	20/24 (83.3%)	24/26 (92.3%)	0.0423
EAC stenosis	5/24 (20.8%)	0/26 (0%)	0.0163
Operative time	45-60 minutes	30-40 mintues	

Discussion

In the context of Endoscopic Tympanoplasty for inactive mucosal chronic otitis media, the comparative data reveals key distinctions between the conventional tympanomeatal flap raising method and the push-through technique.

- Operative Time:

The operative time was notably shorter for the push-through technique (approximately 30–40 minutes) compared to the conventional method (approximately 45–60 minutes).

- Post-operative Pain and Granulations:

The push-through technique showed a favourable profile regarding post-operative discomfort and complications. Specifically, the incidence of post-operative pain was lower (91.7% vs. 61.5%), and the incidence of granulation formation at 3 weeks was significantly lower (29.2% vs. 3.8%). Endoscopic cartilage graft myringoplasty without tympanomeatal flap elevation offers high short- and long-term graft success rate, and the hearing results are satisfactory; the technique is minimally invasive. Findings are in coherence with Lou Z et al.(5)

- Graft uptake and Hearing Improvement

Crucially, in terms of primary outcomes, the two techniques demonstrated similar efficacy:

- Graft uptake rates were better in push through technique at both the 3-week (79.2% vs. 92.3%) and 6-month follow-ups.
- Hearing improvements at 3 months were also comparable (83.3% vs. 92.3%).

Conclusion

Endoscopic Tympanoplasty via the conventional Tympanomeatal flap raising method and the Push-through technique yield similar results concerning graft uptake rate and post-operative audiometry changes.

However, the Push through technique presents several distinct advantages:

- Less complaints of post-operative pain.
- Reduced incidence of granulation tissue formation.
- Less operative and recovery time.

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Case Series

Toros Nose and Its Treatment – Simple But Effective

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ABSTRACT

Introduction

Rhinophyma is a benign slow-progressive nasal skin deformity characterised by hypertrophy of sebaceous gland and connective tissue. It predominantly affects middle-aged and elderly males and can result in significant cosmetic disfigurement and psychological distress. Various treatment modalities have been described, with no single universally accepted approach.

Materials and Methods

This descriptive case series was conducted at a tertiary care centre in Karnataka between January 2023 and December 2025. Six patients diagnosed with Rhinophyma were included in this study. All patients underwent surgical management but one patient opted for medical therapy.

Results

The study included five male and one female patient, with a mean age of 49.5 years. All patients treated with surgery showed satisfactory outcomes. The healing duration ranged from 4 weeks to 3 months. No recurrences or major complications were observed during follow-up (3–24 months). Disease progression was stabilized in patient with conservative treatment. Surgical excision or shaving combined with regular postoperative dressings resulted in effective wound healing with minimal scarring.

Conclusion

Surgical management of Rhinophyma using simple excision or shaving techniques, along with meticulous postoperative care has proven to be a safe, cost-effective, and reliable treatment option. It provides excellent cosmetic results, high patient satisfaction, and minimal recurrence.

Keywords

Rhinophyma; Potato Nose; Acne Rosacea

Rhinophyma, also known as Hebra nose, is a benign slow-progressive nasal skin deformity characterised by hypertrophy of sebaceous gland and connective tissue. It most commonly affects the tip and adjacent regions of the nose and is considered an advanced stage of Rosacea.[1,2] The condition predominantly observed in males over 50 years of age and leads to significant cosmetic disfigurement, distortion of nasal contours, and associated emotional and psychological distress.[1,3]

Historically, Rhinophyma dates back to 18th century which was managed earlier with ineffective methods resulting in recurrences.[4] Recent advances have improved the understanding of tissue healing and newer surgical techniques, more effective and cosmetically acceptable treatment modalities are now available. Management options include both medical and surgical approaches, with the surgery being preferred in advanced cases.

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Materials and Methods

This descriptive case series was carried out in a tertiary care centre in Karnataka from January 2023 to December 2025. A total of six patients diagnosed with Rhinophyma

were included in the study, five patients underwent surgical management under a single surgeon, while one patient opted for conservative (medical) therapy. Patients were enrolled into the study after informed consent. Demographic and clinical findings including age, gender, comorbidities, personal history, lesion characteristics, treatment modality, and follow-up duration were recorded and analysed.

The study population consisted of five male patients and one female patient, with a mean age of 49.5±9.7 years (range: 35–59 years). Most patients (4/6) were referred from the Dermatology department, while two presented directly to the outpatient department. Comorbid conditions included hypertension and diabetes in two patients. An excessive alcohol habit was reported in 1/6 patients and moderate consumption was seen 1/6 patients.

Surgical management primarily involved excision or shaving of the Rhinophyma mass using a diathermy knife or surgical blade, followed by regular postoperative wound care. Conservative management included dermatological interventions such as iso-tretinoin therapy and hydra facial treatments.

Results

All five cases treated with surgery demonstrated favourable outcomes and complete healing with satisfactory cosmetic results. Healing ranged from 4weeks to 3 months depending on the size and extent of lesion.

Case 1:

A 42-year-old male with a long-standing Rhinophyma. On examination, features of large Rhinophyma mass measuring about 3 × 5 × 4 cm was present on the dorsum of nose, broad based, bosselated in appearance and soft to firm in consistency (Fig 1). Patient underwent shaving of the lesion, followed by daily post-operative dressings using sofra-tulle over the raw area. Complete healing with near-normal nasal contour was achieved within 2 months.

a) Pre-operative b) Post-operative
c) Intraoperative d) Specimen

Fig. 1. A 42-year-old male presenting with a large, broad-based, bosselated rhinophyma involving the dorsum of the nose.

Case 2:

A 47-year-old male with a giant pedunculated lesion on the nose from past 10 years extending up to the lower lip and Acne vulgaris. (Fig 2) History of epileptic seizures was observed. On examination a pedunculated mass hanging from the tip of the nose till the lower lip measuring about 10*5cm with a broad base. He underwent complete excision, with recovery achieved in 6 weeks.

Case 3:

A 58-year-old male presented with long standing Rhinophyma since 14yrs, and underwent excision of 5*4*2 cm bosselated appearance of the lesion and recovered fully within 3 months. (Fig 3)

a) Pre-operative b) Post-operative
c) Intraoperative d) Post-operative

Fig. 2. A 47-year-old male with a giant pedunculated rhinophyma. Postoperative follow-up at 6 weeks demonstrating complete healing with satisfactory cosmetic outcome.

a) Pre-operative b) Post-operative

Fig. 3. A 58 year old with bosselated appearance of Rhinophyma and complete recovery in 3 months

Case 4:

A 59-year-old male with nodular Rhinophyma associated with acne vulgaris underwent excision, with complete recovery in 1 month. (Fig 4)

Fig. 4. 59 year old male with nodular Rhinophyma with pre and post operative picture showing complete recovery and restoration in 1 month.

Case 5:

A 56-year-old male underwent surgical shaving (swelling size 2*2*1 cm) following unsuccessful medical therapy of oral antibiotics of doxycycline and low dose iso-tretinoin for 2 months and topical application of azelaic acid for 3 months. Patient achieved complete healing in 4 weeks after surgery.

Case 6:

A 35-year-old female with early-stage Rhinophyma opted for medical management and is undergoing oral antibiotics of Doxycycline and iso-tretinoin with local application of metronidazole and azelaic acid and continues to be under follow-up.

In our study, all patient underwent shaving using

surgical blade no. 15 while preserving the normal surrounding tissue. Maximum post-operative care was provided using chlorhexidine sheet dressing with topical metronidazole and mupirocin and collagen particles application which helped healing of wound with no scarring left behind.(5) Patients were graded pre and post operatively according to Rhinophyma severity index scoring (RHSI), followed up regularly with variation in the time frame of follow up ranging from 3 to 24 months and their post operative satisfaction and cosmetic results were noted. None of our cases showed recurrence until now. Simultaneously treatment for Acne Rosacea of the face was sought by getting dermatologists opinion.

RHINOPHYMA SEVERITY INDEX SCORE

Cases	Pre operative score	Post operative score
1.	6	2
2.	6	1
3.	6	1
4.	4	1
5.	4	1
6.	3	Medical Treatment and Follow up

Discussion

Rhinophyma significantly impacts nasal aesthetics, leading to facial disfigurement and psychological distress. The nose consists of distinct skin types with varying density of sebaceous gland and mobility of skin. Skin on nasal bridge and upper nose is less sebaceous and more mobile. Skin on alae and distal nose is thicker and sebaceous in nature. Skin lining the nares, columella and soft triangle is thin and less dense with sebaceous glands and relatively mobile. Rhinophyma is a benign tumour affecting the nasal skin usually in the lower dorsum and tip of the nose where skin is thick and sebaceous. The lesion is often referred as 'Potato Nose', 'Whiskey Nose', 'Gin Blossom' and is characterised by hypertrophy of sebaceous glands and vascular tissue and is strongly associated with advanced rosacea.[6,7] Although the exact pathophysiology remains unclear, factors such as vasodilation, hormonal influences, and triggers like alcohol and caffeine are believed to contribute. In our series, all patients had underlying features of Acne Rosacea.

Diagnosis of the condition is primarily clinical, with severity classified with the help of validated classification such as the Rhinophyma Severity Index (RHSI) and anatomical classifications[8,9] based on nasal subunits. Management options include both medical therapies (e.g., iso-tretinoin and topical metronidazole) and surgical interventions.[10]

Surgically, Rhinophyma can be treated by various methods. The most popular methods are, excisional techniques like full thickness or partial thickness resection with reconstruction, cryosurgical excision or dermabrasion. Ablative techniques using electro cautery, coblators or radiofrequency ablation using helium plasma. A school of surgeons prefer laser assisted excision in managing Rhinophyma.[11] However, these methods require the need of expensive tools and equipment which might not be widely available. Hence our study done on five patients helps us strongly recommend and believe that a clean surgical resection with regular dressings will certainly help us achieve great results in patients.

Healing in Rhinophyma typically occurs via secondary intention, where healing depends on the functionality of the epithelial remnants and the infundibulum of hair follicles and sebaceous glands.[5,12] In our series, preservation of underlying tissue facilitated effective re-epithelialization with minimal scarring. Radiotherapy, once used historically, is now obsolete due to the risk of secondary malignancies.[13] Our findings suggest that cost-effective surgical approaches, when combined with proper wound care and dermatological management of rosacea, can achieve excellent outcomes without recurrence. Surgical intervention was time efficient with good results thus improving the psychological and emotional state of the patient.

Conclusion

Rhinophyma, though a disfiguring condition, can be effectively managed with timely intervention. Despite the availability of multiple treatment approaches, surgical

excision combined with regular postoperative dressings remains a simple, cost-effective, and reliable approach.

This method has proven to provide excellent cosmetic outcomes, minimal scarring, high patient compliance. It has also improved in psychological well-being significantly. Early diagnosis and appropriate management are essential to prevent progression and ensure optimal results.

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Diagnostic Pitfalls in Salivary Gland Tumours : A Case Series

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ABSTRACT

Introduction

Salivary gland tumours are rare and heterogeneous neoplasms, accounting for 3–6% of head and neck tumours. Pleomorphic adenoma (PA) is the most common benign tumour and is often suspected clinically because of its typical presentation as a painless, slow-growing swelling. However, several other entities may mimic PA, creating diagnostic challenges.

Case Presentation

This case series includes four patients presenting with painless, slow-growing salivary gland swellings: case 1 of the parotid gland, case 2 of the submandibular gland, case 3 of the sublingual gland, and case 4 of the parotid gland, with clinical and imaging features suggestive of pleomorphic adenoma. All patients underwent radiological evaluation, fine-needle aspiration cytology (FNAC), and definitive surgical excision. Cytological interpretation was performed using the Milan System for Reporting Salivary Gland Cytopathology, which gave us the mirage of pleomorphic adenoma in case 1 and salivary gland neoplasm of unknown potential(SUMP) in the remaining three cases, but histopathologically all the four cases were reported differently as case 1 as myoepithelioma, case 2 and 3 as Adenoid cystic carcinoma(AdCC) whose grading was assessed using the MD Anderson grading system and case 4 as Basal cell adenoma.

Conclusion

This case series emphasises the diagnostic overlap between pleomorphic adenoma and other salivary gland tumours such as AdCC and myoepithelioma. FNAC and imaging have limitations in distinguishing these entities, and histopathology remains the gold standard for accurate diagnosis and management. Awareness of this overlap is crucial, particularly in submandibular and sublingual gland tumours, where the probability of malignancy is higher.

Keywords

Salivary Gland Tumours; Pleomorphic Adenoma; Adenoid Cystic Carcinoma; Myoepithelioma; Basal Cell Adenoma; Diagnostic Dilemma; Histopathology

Salivary glands are exocrine glands in the head and neck that produce and secrete saliva into the oral cavity. Their tumours are uncommon, constituting approximately 3–6% of all head and neck neoplasms.[1] Despite their rarity, they demonstrate a remarkable histological spectrum, with the World Health Organization (WHO) recognizing more than 20 distinct benign and malignant subtypes.[2] The parotid gland is most frequently affected, followed by the submandibular, sublingual, and minor salivary glands. A general rule is that the smaller the salivary gland, the higher the likelihood of malignancy.[3]

Among benign neoplasms, pleomorphic adenoma (PA) is the most common, accounting for about 60% of cases. It typically presents as a slow-growing, firm, mobile, and painless swelling, which often leads clinicians to suspect PA initially. However, several other tumors—including adenoid cystic carcinoma (AdCC), myoepithelioma, mucoepidermoid carcinoma, and basal cell adenoma—can present with similar clinical and radiological features. This overlap creates a diagnostic dilemma, particularly since fine-needle aspiration cytology (FNAC) and imaging may have limited ability to distinguish PA from these mimics. Consequently, histopathological examination remains the gold standard for definitive diagnosis.

Among malignant tumours, AdCC warrants special attention due to its paradoxical clinical course—slow progression but aggressive behaviour, characterised by

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perineural invasion, frequent recurrence, and late distant metastasis, most commonly to the lungs and bones. In contrast, myoepithelioma is a rare benign neoplasm derived from myoepithelial cells. While less aggressive than PA, it carries a risk of recurrence if incompletely excised.

Given these challenges, salivary gland tumors that clinically mimic pleomorphic adenoma but prove to be different entities histologically underscore the importance of thorough evaluation and tailored surgical management.

In addition to conventional diagnostic modalities, structured reporting and grading systems are crucial for the evaluation of salivary gland neoplasms. The Milan System for Reporting Salivary Gland Cytopathology (MSRSGC) standardises FNAC reporting into categories with defined risks of malignancy, such as Neoplasm: Salivary gland neoplasm of uncertain malignant potential (SUMP – Milan IVB), which carries an intermediate risk and often warrants excision for definitive diagnosis. Furthermore, the MD Anderson (MDA) histologic grading system for adenoid cystic carcinoma stratifies tumours based on the percentage of solid components—Grade I lacking solid areas, Grade II showing <30% solid, and Grade III demonstrating ≥30% solid—providing important prognostic information.

The integration of structured diagnostic systems improves the accuracy of characterising salivary gland lesions.

In this case series, we present four patients with classical features suggestive of pleomorphic adenoma; however, the final diagnoses varied. These cases highlight diagnostic pitfalls in salivary gland pathology and reaffirm the indispensable role of histopathology in accurate classification and management planning.

Case 1 : Myoepithelioma of Parotid Gland

A 62-year-old male presented to our department with a painless, slow-growing swelling in the preauricular region of two years' duration. On clinical examination, a firm, ovoid swelling measuring approximately 5 × 3 cm was noted in the parotid region, extending superiorly up to the zygomatic arch, inferiorly just below the angle of the mandible, and posteriorly up to the mastoid process, with a smooth surface and well-defined margins (Figure 1A). No facial nerve weakness was observed. Ultrasonography

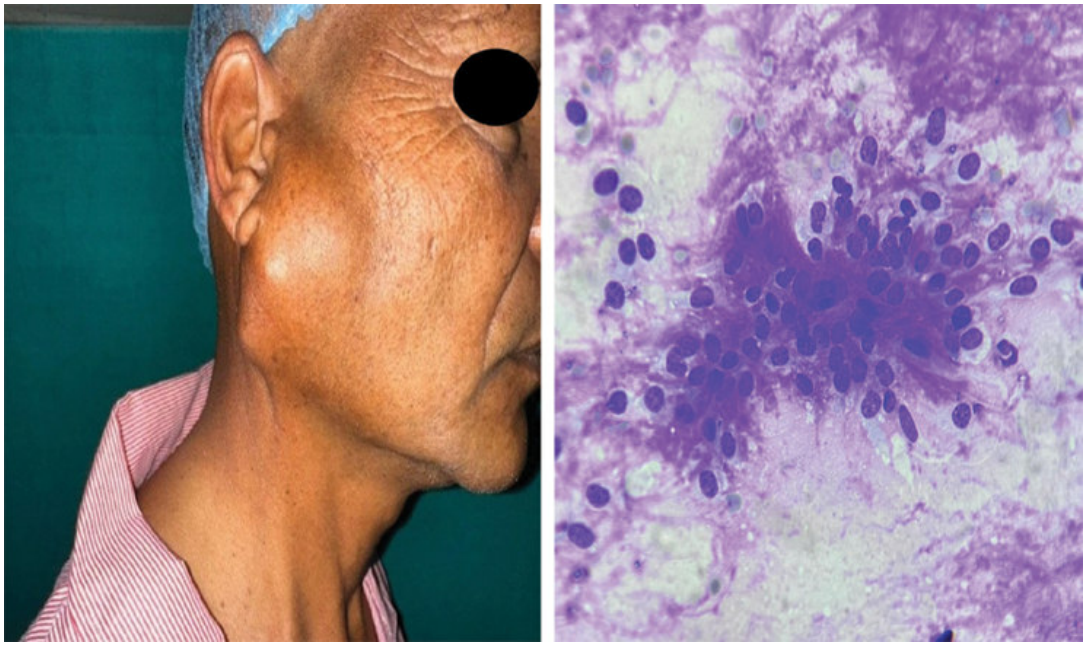

Fig. 1. Showing preoperative clinical image (a) and cytopathology; H&E staining at 40X (B) which is suggestive of pleomorphic adenoma of parotid gland

and contrast-enhanced magnetic resonance imaging were suggestive of pleomorphic adenoma. Fine-needle aspiration cytology revealed sheets and cohesive clusters of ductal epithelial cells admixed with round to spindle-shaped myoepithelial cells in a scant chondromyxoid, feathery stroma with a hemorrhagic background. No cellular atypia was noted, and the findings were suggestive of pleomorphic adenoma (Figure 1B).

Total parotidectomy was performed. Histopathological examination revealed a tumor composed of sheets of round to polygonal cells with round to oval nuclei, vesicular chromatin, and a moderate amount of eosinophilic to clear cytoplasm. Mild intratumoral edema and microcystic changes were observed, along with infrequent small acinar structures. No mitotic activity or necrosis was identified. The initial impression was that of a primary low-grade, myoepithelial-rich salivary gland neoplasm, with differential diagnoses including myoepithelioma and epithelial–myoepithelial carcinoma (Figure 2). Immunohistochemistry demonstrated positivity for CK, p40, SOX10, and CK7, confirming the diagnosis of myoepithelioma. On follow-up, the patient developed Grade IV facial nerve weakness, which subsequently improved with facial physiotherapy and conventional medical management.

Case 2 : Adenoid cystic carcinoma of the submandibular gland

A 32-year-old female presented to our department with a painless, slow-growing swelling in the right submandibular region of two months' duration. Clinical examination revealed a solitary, firm to hard swelling measuring approximately 4 × 3 cm, located below the angle of the mandible in the submandibular fossa and palpable bimanually, with no associated cranial nerve weakness. Ultrasonography and contrast-enhanced computed tomography demonstrated a well-defined lesion measuring 3.6 × 2.8 cm, suggestive of pleomorphic adenoma of the submandibular gland (Figure 3A). Two fine-needle aspiration cytology samples were obtained: the first, reported from an outside centre, was consistent with pleomorphic adenoma, while the second, evaluated at our institution, was categorised as a salivary gland neoplasm of uncertain malignant potential (SUMP) corresponding to Milan System category IVB, carrying an estimated

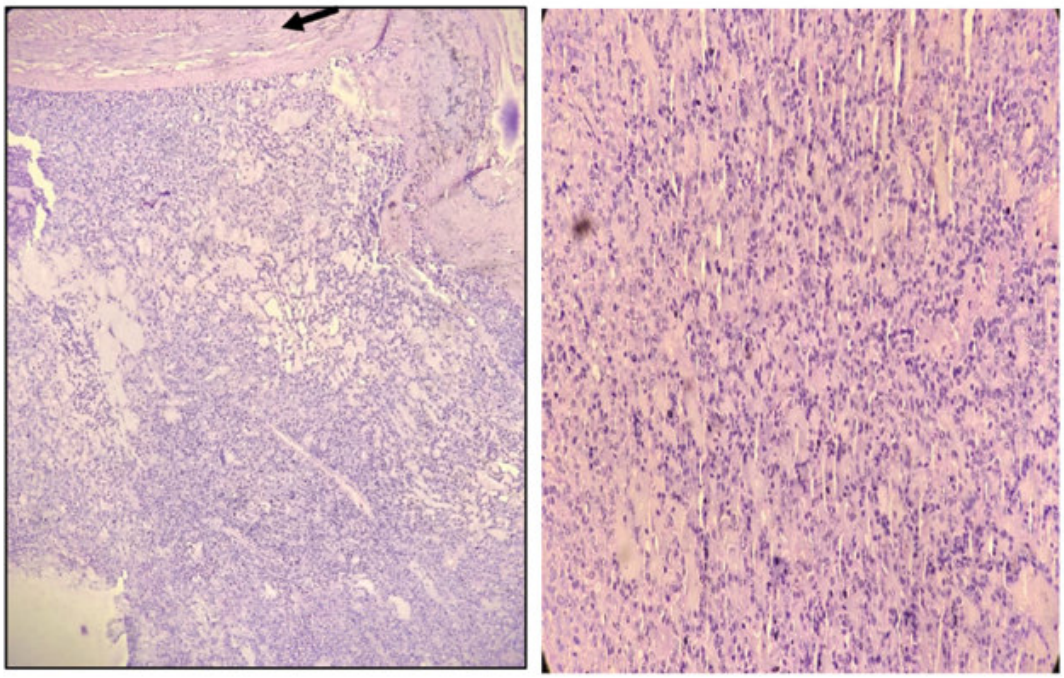

Fig. 2. Showing histopathology of myoepithelioma in 10X and 40X (H & E Staining)

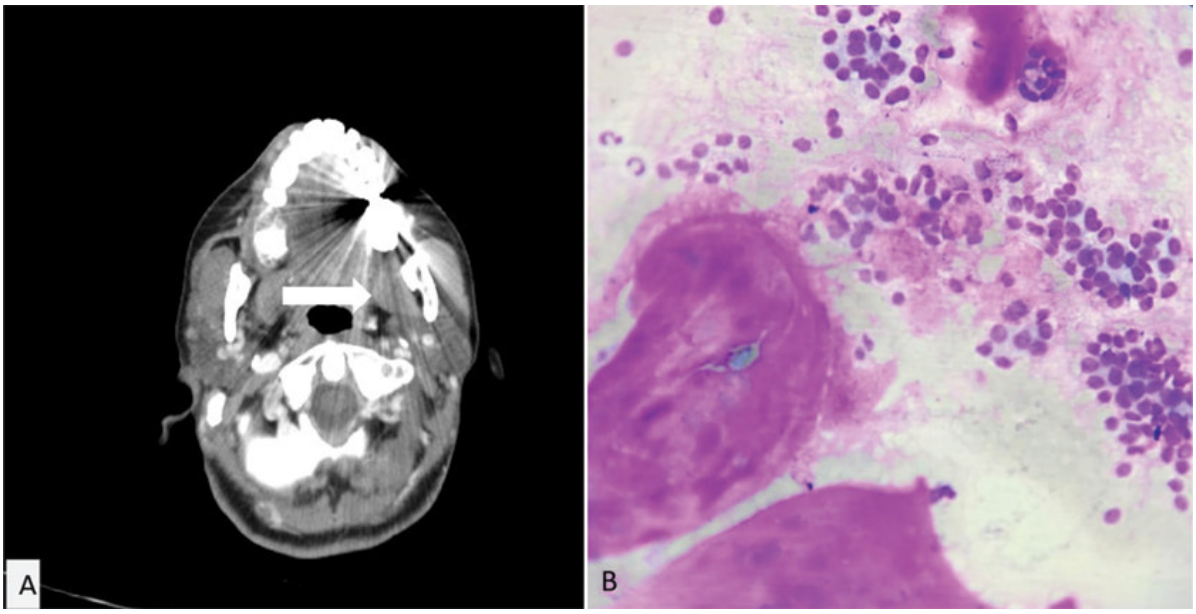

Fig. 3. Showing preoperative radiologival image of tumor (A) and cytopathology image; H & E staining (B) at 40X suggestive of milan category IVB

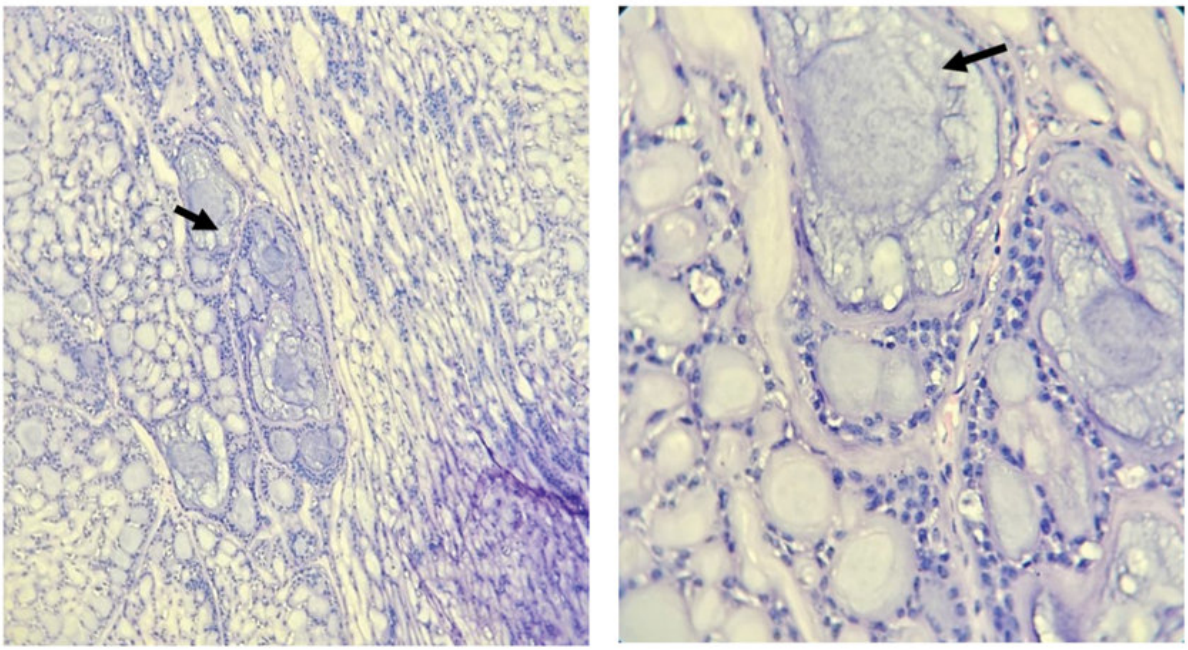

Fig. 4. Histopathology of Adenocystic Carcinoma of submandibular gland (MD Anderson Grade 1) at 10X and 40 X [H & E Staining]

35% risk of malignancy. This categorisation guided the decision to proceed with complete surgical excision for definitive diagnosis (Figure 3B).

Submandibular gland excision with meticulous nerve preservation was performed. Histopathological examination revealed tumor cells arranged predominantly

in a cribriform architecture, with only occasional tubular and solid components. The tumor cells were predominantly myoepithelial, exhibiting numerous hyaline globules and extensive stromal hyalinization. Focal areas showed myoepithelial cells with clear cell change. There was no significant pleomorphism or mitotic activity, and no evidence of necrosis, perineural invasion, or lymphovascular invasion was identified. The overall features were consistent with adenoid cystic carcinoma of the submandibular gland, classified as MD Anderson Grade I (Figure 4). MD Anderson Grade I denotes the absence of solid areas and is associated with the most favorable prognosis in adenoid cystic carcinoma grading.On follow-up, contrast-enhanced computed tomography of the chest was performed to evaluate for distant metastasis. Metastatic disease was detected, following which the patient underwent radiotherapy as part of the management for metastatic involvement.

Case 3 : Adenoid cystic carcinoma of the sublingual gland

A 26-year-old male presented to our department with a painless, slow-growing swelling in the floor of the mouth for a duration of two months. On clinical examination, a solitary, hard, fixed, and tender swelling measuring approximately 6 × 2 cm was noted in the floor of the mouth, extending deep into the submental space. Ultrasonography and contrast-enhanced magnetic resonance imaging were suggestive of pleomorphic adenoma (Figure 5A). Fine-needle aspiration cytology revealed cohesive clusters and sheets of basaloid cells, at times forming acinar structures, along with singly scattered cells demonstrating a high nuclear-to-cytoplasmic ratio. Based on these findings, the lesion was categorised as a salivary gland neoplasm of uncertain malignant potential (SUMP), corresponding to Milan System grade IVB. The cytomorphological features were suggestive of a cellular neoplasm with basaloid characteristics (Figure 5B).

Sublingual gland excision with meticulous nerve preservation was performed. Histopathological examination revealed a biphasic malignant salivary gland tumour composed of ductal and myoepithelial cells arranged in multiple nodules exhibiting lobular, cribriform, and focally solid architectural patterns, separated by thick fibrous hyalinized septae. Perineural invasion was identified. Although the exact proportion of the solid

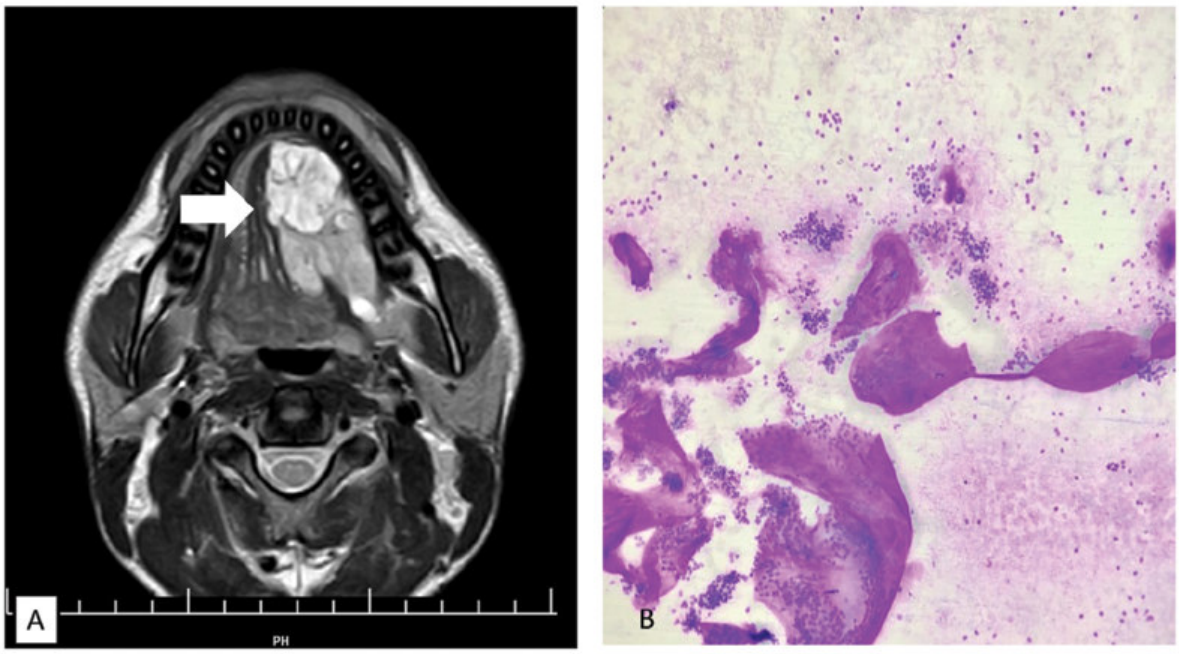

Fig. 5. Preoperative radiological image (A) and cytopathology {40X}; H & E Staining (B)

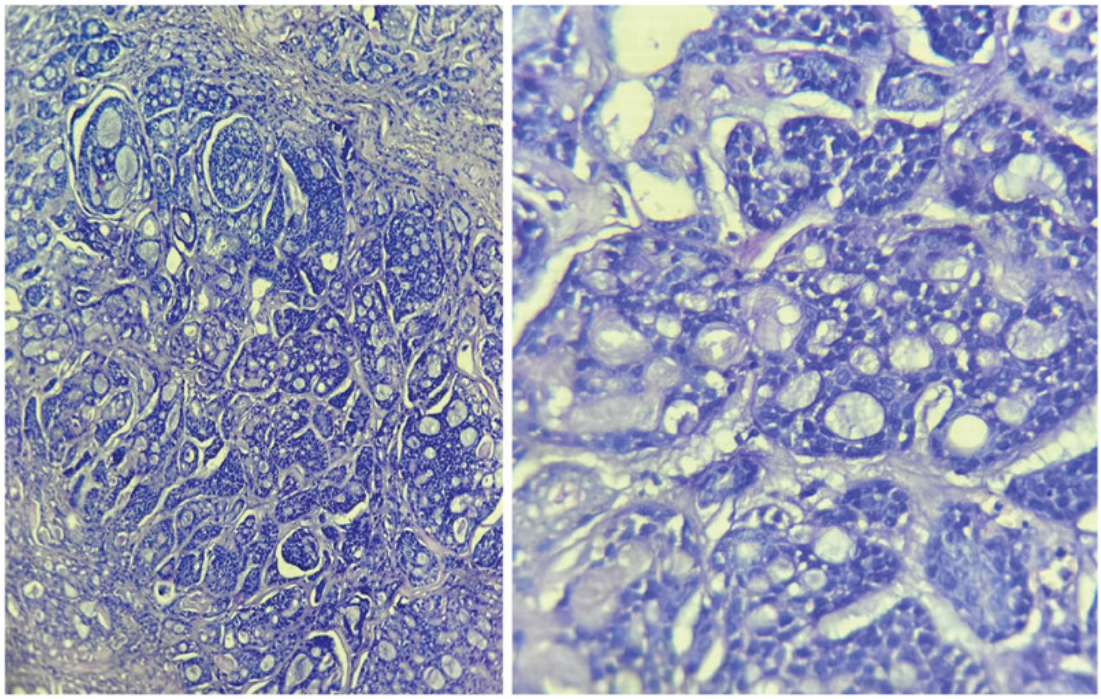

Fig. 6. Showing a histopathological image of the sublingual gland, Adcc at 10X and 40X (H & E Staining)

component was not quantified, the presence of solid areas indicates that the lesion is at least MD Anderson Grade II and may qualify as Grade III if the solid component comprises 30% or more. The overall histomorphological features were consistent with adenoid cystic carcinoma, cribriform type, with perineural invasion (Figure 6).On follow-up, the patient was sent to the Oncology Department for further management.

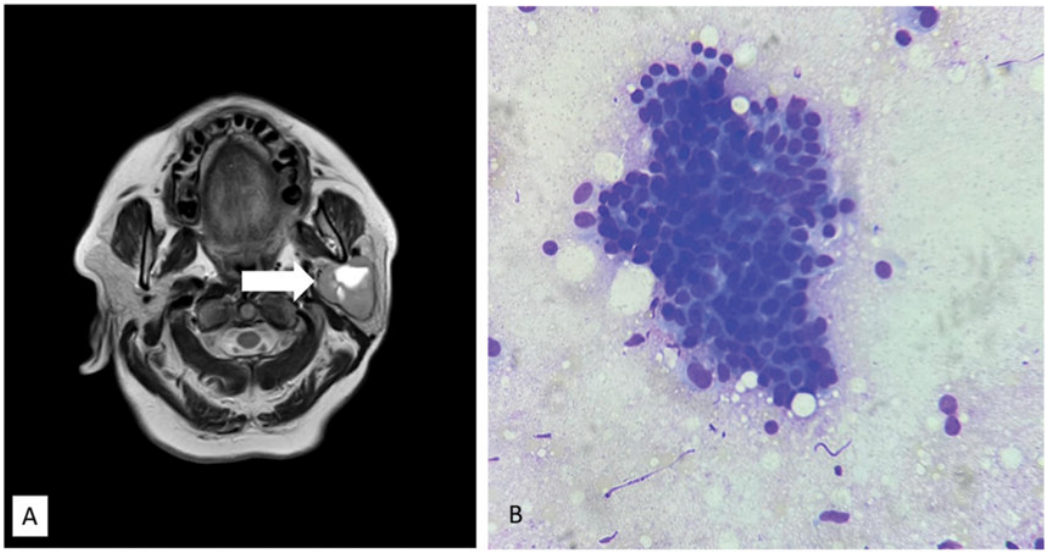

Fig. 7. Showing preoperative radiological image (A) and Cytopathology {40X}; H & E staining (Cellular basaloid Neoplasm) of Tumor (B)

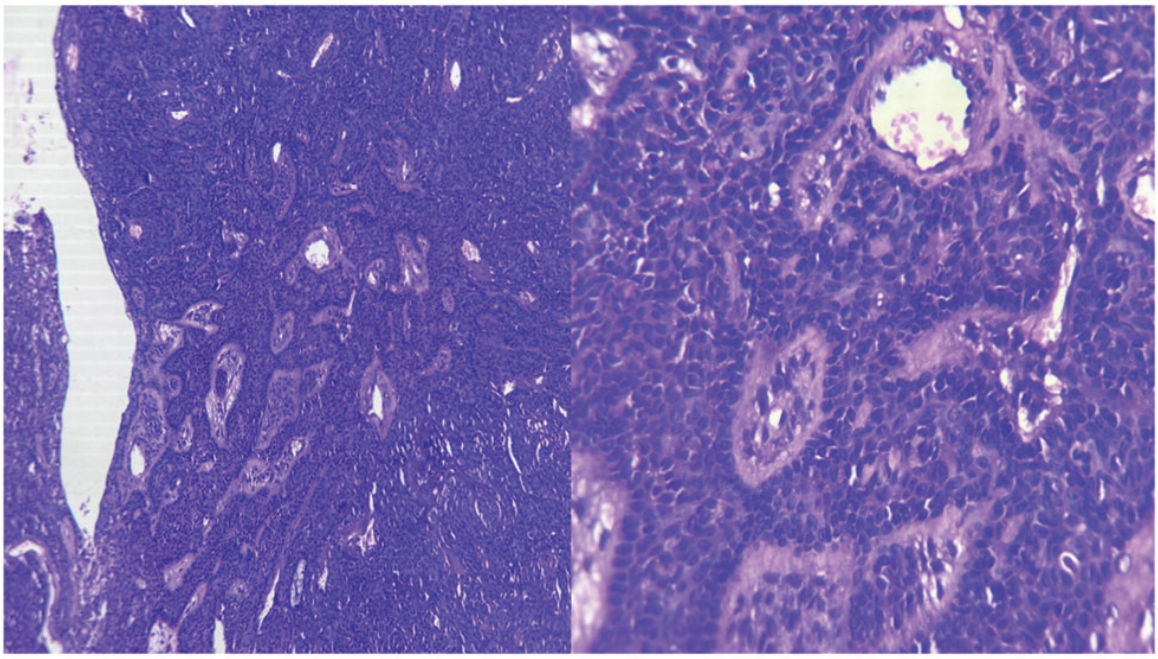

Fig. 8. Showing histopathology image at 10X and 40X respectively suggestive of basal cell adenoma (H & E Staining)

Case 4 : Basal cell adenoma of the deep lobe of the parotid gland

A 64-year-old female presented to our department with a painless, slow-growing swelling in the left parotid region of three years' duration. On clinical examination, a solitary, firm to hard swelling measuring approximately 4.5 × 3.5 cm was noted in the infra-auricular region of the parotid gland, with a smooth surface and well-defined margins. No facial nerve weakness was observed. Ultrasonography and contrast-enhanced magnetic resonance imaging were suggestive of pleomorphic adenoma of the gland (Figure 7A). Fine-needle aspiration cytology was reported as a salivary gland neoplasm of uncertain malignant potential (SUMP), characterised as a cellular basaloid neoplasm (Figure 7B).

Total parotidectomy with meticulous facial nerve preservation was performed. Histopathological examination revealed a well-circumscribed, encapsulated, and cellular tumor composed of basaloid cells arranged in solid and trabecular patterns, exhibiting round nuclei and scant cytoplasm within a fibrocellular stroma. The overall features were suggestive of basal cell adenoma (Figure 8). On follow-up, the patient developed Grade II facial nerve weakness. The weakness improved with facial physiotherapy and conventional medical management, with subsequent recovery noted.

Discussion

Salivary gland tumors present a unique diagnostic challenge due to their clinical and histological diversity. Although pleomorphic adenoma (PA) is the most common benign neoplasm, accounting for nearly 60% of all salivary gland tumors,[1,4] several other tumours can closely mimic its presentation. In our case series, all four patients presented with features highly suggestive of PA but were ultimately diagnosed as adenoid cystic carcinoma (AdCC) of the sublingual and submandibular glands, myoepithelioma of the parotid gland and Basal cell adenoma of deep lobe of parotid gland on histopathology.

This clinical overlap is well-documented in the literature. Eveson and Cawson[3] observed that tumors of the submandibular and sublingual glands carry a higher likelihood of malignancy compared to the parotid. Similarly,

Seethala[5] emphasized that AdCC and other malignant tumors may present as slow-growing, painless swellings, often indistinguishable from PA preoperatively. FNAC, while valuable, has shown variable diagnostic accuracy; in an extensive review, Stewart et al. [7] reported sensitivity rates ranging from 70% to 90%, with misdiagnosis frequently occurring in differentiating PA from AdCC and myoepithelioma.

Among malignant tumours, AdCC is particularly notorious due to its indolent yet aggressive behaviour. It demonstrates a high propensity for perineural invasion and local recurrence, with long-term survival affected by late distant metastasis to the lungs and bones.[8,9] Our two cases of AdCC underscore the importance of maintaining a high index of suspicion for malignancy, particularly in tumors arising in the sublingual and submandibular glands, where the probability of malignancy may exceed 50%.[11]

Myoepithelioma, on the other hand, represents a rare benign tumor composed exclusively of myoepithelial cells. It accounts for less than 1% of all salivary gland neoplasms.[12] Clinically, it is almost indistinguishable from PA, and definitive diagnosis relies solely on histopathological and immunohistochemical evaluation. Though benign, recurrence can occur if the tumor is incompletely excised, warranting complete surgical removal with clear margins.

Basal cell adenoma (BCA) involving the deep lobe of the parotid gland is a rare pathological entity, accounting for approximately 1–3% of all salivary gland neoplasms[15]. While the majority of benign parotid tumours occur in the superficial lobe, recent retrospective data suggest that the deep lobe may be more prone to developing BCAs than previously thought; studies report that up to 37.9% of BCAs are located in the deep portion,[16] which is similar to our case. Clinically, deep lobe BCAs often present as asymptomatic, slow-growing masses that may remain undetected until they displace the lateral oropharyngeal wall or the parapharyngeal space.[17] Preoperative diagnosis via Fine Needle Aspiration Cytology (FNAC) is notoriously difficult due to the "basaloid" overlap with more aggressive malignancies like adenoid cystic carcinoma or basal cell adenocarcinoma; however, MRI findings of a well-circumscribed mass with substantial enhancement and a higher frequency of cystic degeneration (found in 45.5% of deep lobe cases) can be suggestive.[16,18] Surgical management typically necessitates a total parotidectomy or a deep lobe excision with meticulous facial nerve dissection, as the tumour's medial position requires the nerve to be fully mobilised for safe removal[19]. While the prognosis for most subtypes is excellent, the membranous variant requires long-term surveillance due to a reported recurrence rate of up to 25% and a higher risk of malignant transformation.[20]

The present case series highlights three essential points:

1. Diagnostic Dilemma – Pleomorphic adenoma remains the leading preoperative clinical suspicion, but malignant tumors (especially AdCC) may mimic its presentation.
2. Limitations of FNAC and Imaging – These tools are helpful for initial assessment but may not reliably distinguish PA from histological mimics.
3. Indispensable Role of Histopathology – Final diagnosis rests on comprehensive histopathological examination, which dictates prognosis and management.

The application of a standardised classification system enhances diagnostic accuracy and management planning. In cases 2 and 3, FNAC was categorised as MILAN system Category grade IV (SUMP), which carries an intermediate risk of malignancy of approximately 35%.[13] This justified surgical excision for definitive diagnosis.

Furthermore, grading of adenoid cystic carcinoma using the MD Anderson system provides valuable prognostic information. Case 2 demonstrated MD Anderson grade I, lacking solid components and therefore associated with comparatively favourable outcomes. In contrast, case 3 exhibited cribriform morphology with focal solid areas and perineural invasion, indicating a more aggressive tumour – at least MD Anderson grade II, with potential to be grade III if solid areas exceed 30%.

Incorporating both the MILAN and MD Anderson grading systems framework for cytologic interpretation, histopathologic stratification, and clinical decision-making, reinforcing their importance in evaluating salivary gland neoplasms.

Our findings are consistent with the literature, which emphasises the need to correlate clinical, radiological, cytological, and histopathological data to ensure accurate diagnosis and optimal treatment planning.

Conclusion

Salivary gland tumours encompass a broad spectrum of benign and malignant neoplasms, many of which can present with features mimicking pleomorphic adenoma. This case series demonstrates the diagnostic challenges posed by such mimics, including adenoid cystic carcinoma, myoepithelioma and basal cell adenoma. While clinical presentation and FNAC may suggest PA, histopathology remains the gold standard for definitive diagnosis.

Clinicians should exercise caution in assuming a diagnosis of pleomorphic adenoma, particularly in submandibular and sublingual gland swellings, where the risk of malignancy is significantly higher. A multidisciplinary approach that combines careful clinical evaluation, imaging, cytology, and histopathological confirmation is essential to ensure accurate diagnosis and guide appropriate surgical management.

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Case Report

Internal Jugular Phlebectasia - A Rare Case

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ABSTRACT

Introduction

Since less than 250 cases of Internal jugular phlebectasia have been reported in the literature, it is a very rare condition which is often misdiagnosed clinically. This case report will contribute significantly to the sparse literature reviews available on this condition.

Case Report

4-year-old boy who belonged to low socio-economic strata was having congenital swelling in neck which increased in size on elevating intrathoracic pressure which was further diagnosed to be internal jugular vein phlebectasia .Patient was managed conservatively and was kept under observation with regular monitoring

Discussion

Neck swelling has several different differential diagnosis depending upon clinical course and characteristics. Phlebectasia though rare should be considered as one of the diagnosis while evaluating a case of neck swelling. Internal jugular phlebectasia is managed conservatively with regular follow up in most cases and surgical intervention is done in cases with complications or for cosmetic reasons

Keywords

Internal jugular vein, Phlebectasia, Venous dilatation, Neck mass

Phlebectasia means dilatation of vein, it may affect any vein of the neck but most affected is the internal jugular vein subsequently external jugular and superficial communicans.[1] It is a benign swelling with unknown etiology.[2] Its incidence is very rare.[3] Clinically it most commonly presents as soft and painless swelling in the neck which increases with rise in intrathoracic pressure like Valsalva maneuver.[4] As this condition is extremely rare there is no definitive cause but primary lack of elasticity of venous wall can be a reason in congenital cases.[5] Elevated pressure in the vein is another hypothesis that may cause phlebectasia.[6] Right sided IJV is more commonly involved than left because right innominate vein is in close contact with right apical pleura an increase in intrathoracic pressure will be transmitted to right IJV .The left IJV is located more medially so it does not receive any such stress[7].It is diagnosed by performing Ultrasound (USG) along with Doppler flow imaging and Computed tomography (CT) angiography.[8] It is generally diagnosed in childhood but incidentally may be found in adults.[9] It is managed conservatively but surgery can be done for cosmetic reasons or to avoid complications such as thrombosis or enlargement of dilatation.[10]

Case Report

4-year-old male child born out of consanguineous marriage presented to our department with history of congenital unilateral swelling over right side of neck as shown in fig 1. Swelling was gradually increasing in size with age. Patient also stated that swelling enlarged on coughing, crying and straining and was not associated with any pain, dysphagia, dysphonia, breathing difficulty or any other neck swelling. There was no history of similar complains in family. On examination patient had swelling on right side of neck that was 4*5 cm in size it became more prominent on performing Valsalva maneuver. The swelling was soft, compressible, non-tender. On

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auscultation there was no bruit. Subsequently USG neck with doppler flow was performed which showed significant dilatation of right internal jugular vein on Valsalva maneuver- likely phlebectasia as shown in fig. 2. The child is under conservative management and regular follow –up .

Fig. 1. Swelling right side of neck

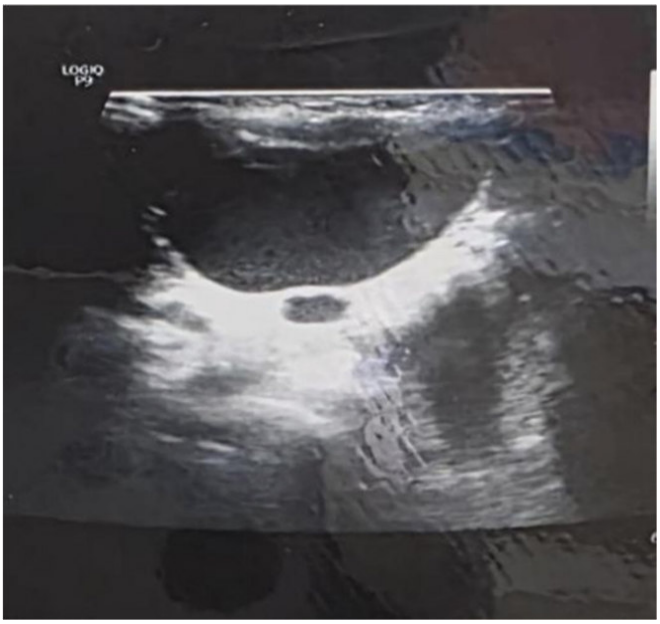

Fig. 2. USG neck showing phlebectasia

Discussion

Phlebectasia was seen in internal jugular vein in studies of SYet al chung,[11] Alberia S. et al[8] which agrees with our study. Internal jugular phlebectasia(IJP) mostly presents as unilateral swelling as in our study but in study of Feguera et al[12] bilateral IJP was found in few pediatric cases .In the study of Krstacic A et al[13] and Thulasiraman V et al[14] adult IJP was most commonly found on left side and on the right side in children similarly it was found on right side in 4 year child in our case .In some studies it has been found that phlebectasia is associated with conditions such as Neurofibromotasis type 1 and Ehler Danlos syndrome.[15,16] Road Traffic Accidents was the cause in study of Rha et al,[17] But there was no such association in our case.

Conclusion

Internal jugular phlebectasia is a rare benign case which is most frequently found in children. Gold standard investigation for its diagnosis is ultrasound doppler imaging. In majority of the cases, it is managed conservatively, Surgical management is done only for cosmetic reasons or in those having complications. Though rare but, phlebectasia should be kept in mind as one of the differential diagnosis while evaluating a case of neck swelling.

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Recurrent Inflammatory Myofibroblastic Tumor of Sternocleidomastoid Muscle

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ABSTRACT

Introduction

Inflammatory myofibroblastic tumour (IMT) is a rare intermediate grade mesenchymal lesion with low metastatic potential and a high propensity for recurrence. Most commonly affected sites are lungs, abdomen and pelvis. Head and neck IMTs account for 5% of all IMTs with IMT of sternocleidomastoid muscle being exceptionally rare.

Case Report

A 35 year old female presented with a nodular mass lesion over skin in the left infra auricular area. She had a previous history of swelling at the same site with excision done, and histopathological report revealed inflammatory myofibroblastic tumour. Radiological evaluation was suggestive of neoplastic etiology. Intraoperatively mass was seen over the sternocleidomastoid muscle infiltrating overlying skin. Excision of mass was done along with superficial parotidectomy. Histopathological examination revealed ALK positive inflammatory myofibroblastic tumour of sternocleidomastoid infiltrating the superficial parotid gland.

Discussion

Inflammatory myofibroblastic tumours are extremely rare in head and neck region and have a tendency to recur. Complete resection is the treatment of choice and histopathological examination with IHC is confirmatory for diagnosis.

Keywords

Myofibroblastic Tumor; Sternocleidomastoid; Mesenchymal

According to the World Health Organization (WHO), inflammatory myofibroblastic tumour (IMT) is classified as an intermediate, rarely metastasising mesenchymal tumor which is histopathologically characterised by myofibroblastic spindle cell proliferation with mixed infiltration of plasma cells, lymphocytes and eosinophils.[1] IMT can originate in different anatomical sites with lung being the most common. Extrapulmonary IMT are seen more frequently in abdomen and pelvis, with a predilection for younger patients especially in the first and second decades. Head and neck IMT account for 5% of all IMTs and 14% to 18% of all extrapulmonary IMT.[2,3]

The discovery of rearrangement of the anaplastic lymphoma kinase (ALK) gene demonstrated IMT as a type of true neoplasm instead of an inflammatory reaction. Anaplastic lymphoma kinase (ALK) genes rearrangement have been seen in approximately 50% of IMT and has become a widely accepted marker for IMT.[3,4] Inflammatory myofibroblastic tumours of the head and neck region can clinically mimic malignancy.[8] It is hence warranted that a complete resection of the tumour should be done with histopathological examination and IHC staining for a definitive diagnosis.

Case Report

A 35-year-old female presented with a nodular mass in the left infra-auricular region for a duration of eight months. On taking history, it was found that a swelling had been reported previously at the same site which was excised under local anaesthesia and was reported as inflammatory myofibroblastic tumour, ALK 1 and SMA positive. No

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other details of the surgical procedure were available.

On examination, a nodular mass was seen in the left infra auricular region with overlying skin infiltration (Figure 1). It was mobile and non-tender. Scar from previous surgery was visible and was non-tender.

Fig. 1. Clinical Picture Showing nodular lesion

Patient was subjected to a Contrast enhanced computed tomography of the face and neck. The CT scan revealed a heterogeneous enhancing subcutaneous soft tissue density mass lesion measuring approximately 24 x 16 mm in the left parotid region. This lesion had infiltrated into the adjacent superficial lobe of the left parotid gland, the inferior part of the left external ear, and the adjacent sternocleidomastoid muscle. The CT findings were suggestive of an infective or neoplastic etiology.

An MRI of the face and neck revealed a well-defined heterogeneous mass lesion measuring approximately 18 x 13 x 19 mm involving left sternocleidomastoid muscle and skin with infiltration of the adjacent superficial lobe of parotid gland without extension to the deep lobe. The lesion appeared hypointense on T1W, heterogenously hyperintense on T2W, hyperintense on TIRM, and showed minimal post-contrast enhancement. There was suppression on FAT SAT images. (Figure 2)

After pre anaesthetic checkup, the patient was planned for excision of mass under general anaesthesia. A modified Blair incision was given and the SMAS flap was elevated. A firm nodular mass was observed over the anterior

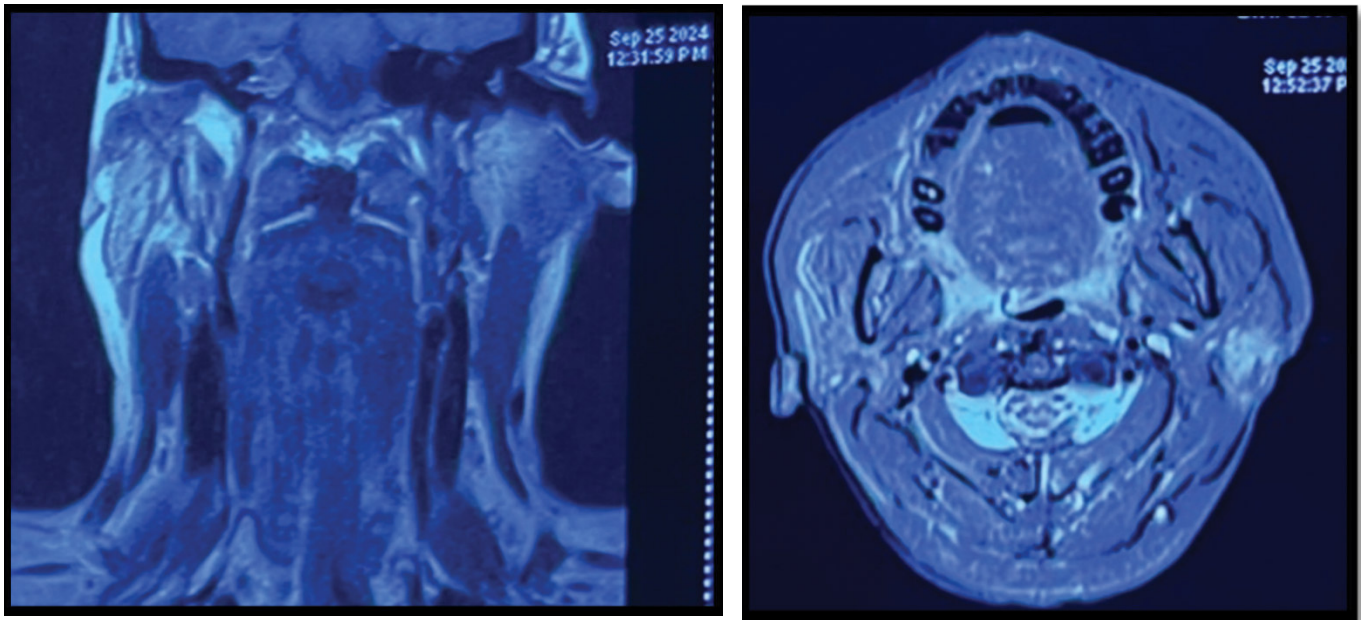

Fig. 2. MRI demonstrating the lesion over left SCM infiltrating skin and adjacent parotid gland

border of the upper one-third of the left sternocleidomastoid along with infiltration of the overlying skin

The lesion was removed in toto with adequate margins and the superficial part of the left parotid gland. Hemostasis was achieved, and the incision was closed in two layers.

Histopathological examination of the surgical specimen suggested an inflammatory myofibroblastic tumour of the left sternocleidomastoid infiltrating into the superficial parotid gland. (Figure 3) Immunohistochemistry revealed ALK positivity (Figure 4)

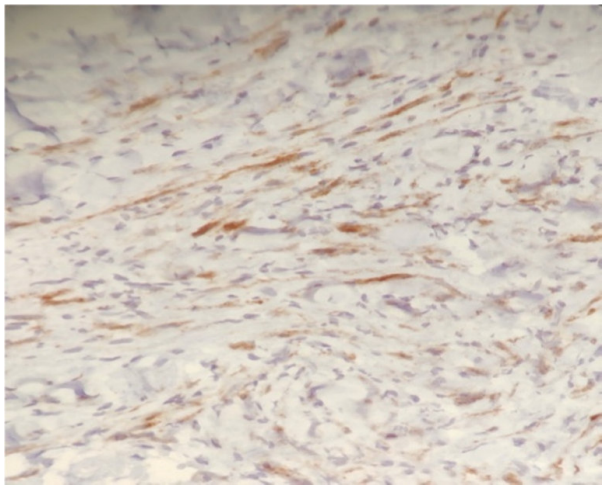

Fig. 3. Granular cytoplasmic ALK positive tumour cells

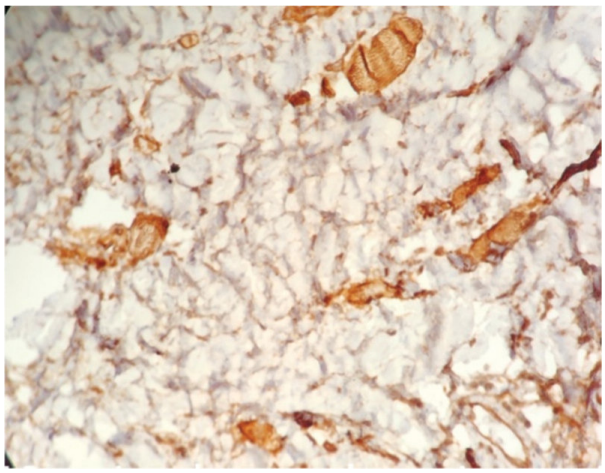

Fig. 4. Desmin positive spindle cells infiltrating skeletal muscle fibres

Discussion

Inflammatory myofibroblastic tumors (IMTs) are rare lesions that present with non-specific clinical features, often making their diagnosis difficult based solely on clinical grounds. While literature suggests that IMTs predominantly occur in children and young adults, typically in the first and second decades of life,[2] our patient presented at the age of 35, which is relatively uncommon.

Imaging is frequently used as initial approach to evaluate head and neck masses, the radiological appearance of IMs in this region can be highly variable. This variability is influenced by the lesion's fibrotic content, degree of inflammatory infiltrate, and stage of disease progression. Consequently, imaging alone is often insufficient for making a definitive diagnosis.[6] Clinico-radiological differentiation of IMT from other malignant tumors can be difficult preoperatively, as observed in our case.

Given these challenges, histopathological examination remains the cornerstone for confirmation. Immuno-histochemistry (IHC) is essential for identifying the myofibroblastic phenotype of these tumors. IMT cells typically express muscle-specific markers such as smooth muscle actin (SMA), desmin (DES), and vimentin. Among these, SMA and ALK (anaplastic lymphoma kinase) positivity are particularly helpful in supporting the diagnosis.[6,7,8] The identification of ALK expression has also opened avenues for targeted therapy using ALK inhibitors.

Emerging research highlights the role of cyclooxygenase-2 (COX-2) in the pathogenesis of head and neck IMT. COX-2–driven inflammation is believed to contribute to tumor invasiveness. Tumors expressing both ALK and COX-2 appear to have a worse prognosis, suggesting a potential benefit from combined ALK and COX-2 inhibitor therapy in adjuvant settings.[4]

Despite advances in molecular therapies, surgical excision remains the primary treatment for head and neck IMTs. The presence of clear surgical margins is the most critical factor in preventing local recurrence.[5] Although IMTs generally have a favorable prognosis, their incomplete encapsulation and proximity to vital structures

in the head and neck can make complete excision difficult, resulting in recurrences. Studies have shown recurrence rates of 31% in ALK-negative and up to 69% in ALK-positive extrapulmonary IMTs. [9] In the present case, initial surgery failed to achieve complete resection, which led to tumor recurrence. A more aggressive excision was subsequently performed. Due to their unpredictable biological behavior, patients with IMT require close follow-up to monitor for recurrence. Our patient is currently disease-free under follow-up.

While several IMT cases have been reported from India, a comprehensive literature review revealed that this is the first reported case of an IMT arising in the sternocleidomastoid muscle with direct extension into the parotid gland. This case underscores the need to consider IMT in the differential diagnosis of atypical neck masses.

In conclusion, extrapulmonary IMTs are rare tumors that require histopathological confirmation and IHC staining for diagnosis. Surgery remains the treatment of choice, although ALK-targeted therapies offer additional options for unresectable, aggressive cases and in adjuvant settings.

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