Research Paper Medical Science

Efficiency of 5 Day Course Oral Itraconazole in Management of Recurrent Otomycosis in Diabetic Patients- a Randomized Control Clinical Trail

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ABSTRACT

Otomycosis (or fungal Otitis externa) is a troublesome infection of External ear usually by Aspergillus or Candida. Chronic and recurrent Otomycosis is frequently seen in Diabetic and elderly patients. This study highlights that Oral Itraconazole at a daily dose of 200mg/day for 5 days is an effective and safe remedy for treatment of Otomycosis in Diabetic patients. In addition early and quasi-urgent eradication of fungus provides for prevention of Fungal Malignant Otitis externa, (Invasive Otitis externa) or Skull base osteomyelitis.

KEYWORDS | Aspergillus, Candida, Aspergillus niger, Otitis externa, Otomycosis, Swimmer's ear, Itraconazole, Oral anti fungal, Diabetes mellitus

INTRODUCTION

Otomycosis (or fungal Otitis externa) is a common and recurrent complaint in patients living in Hot and humid environment. This is often offset by usage of Steroid ear drops and Antibiotic use. Patients with Diabetes mellitus are at higher risk developing a complicated form Otitis externa known as Malignant Otitis externa, (Invasive Otitis externa) or Skull base osteomyelitis.

Methodology

A cohort of 20 type 2 Diabetes mellitus patients was selected from the Out-patient clinic at our Hospital from 1 May 2015 till 1 October 2015.

research Design of the study

The type of clinical trial was Randomized control trial unblinded (open) Parallel group design, both groups were managed local treatment like suction, irrigation and topical Clotrimazole ear drops. The study group was administered oral antifungal and control group was not given any oral drugs.

Figure 1: Research Design followed in our study

Study groups were assigned to random groups by Simple random number table. Patients were not blinded as patients had no active role in the outcome. The final grading outcome was carried out by our colleague doctors who were blinded and did not have any knowledge of the administered treatment.

Trail was carried on for 3 to 6 weeks, at the end of which patients was released from trial. The goal of the study was to show superiority or higher cure rates with Oral-Antifungal Itraconazole.

Selection criteria

1. Confirmed Diabetes mellitus for duration of 1 year and onwards
2. Age greater than 40 years
3. More than 1 episode of Fungal Otitis externa – Proven by Culture of ear swab, and treatment by using toilet and removal of the debris and topical anti-fungal drop.
4. Free from any Diabetes related complications like Chronic Renal failure

Disease criteria

1. Clinically proven Fungal disease by Oto-endoscopy, Oto-microscope, 2 Ear swabs were taken.

First swab material was examined in the ward side lab after heating with 10% potassium hydroxide solution and a search was made for (hyphae, conidia and Aspergillus heads).The second Ear swab inoculated on Sabouraud's Dextrose Agar (SDA) with antibiotics and 25°C and 37°C for a minimum period of 4 weeks. The culture tubes were examined for the presence of growth every day.

2. Identification of mycelium (hyphae, conidia and Aspergillus heads) was done by Gram's Stain followed by Lactophenol Cotton Blue Mount preparation and Slide culture examination was used for differentiation of morphology.

CONSENT and Ethical consideration

Hospital ethical approval was obtained and also written consent was obtained from each patient before inclusion into study.

End POINT / Cure criteria

Observing a dry ear free of fungal debris using Oto-endoscope and Oto-microscope. (Grade 0)

Following that patients were followed up to 3 to 6 weeks to ensure no recurrence of the pathogen.

GRADING OF DIASEASE

Grading of disease severity was done as the following table; Grading was done at first visit followed up till final visit or end-point 6 weeks

TABLE – 1
grading of otomycosis (developed by authors)

Observation criteria	Grade of Disease
External Auditory canal dry No fungal debris Tympanic membrane pearly white	Normal ear 0 Zero
External Auditory canal wet Minimal fungal debris in floor of EAC	Minimal Grade 1
External Auditory canal wet Fungal debris around 50% of EAC	Moderate Grade 2

External Auditory canal wet Fungal debris completely filling up the EAC	Severe Grade 3
External Auditory canal wet Fungal debris completely filling up the EAC Excoriation of pinna and EAC	Super added bacterial infection Grade 4

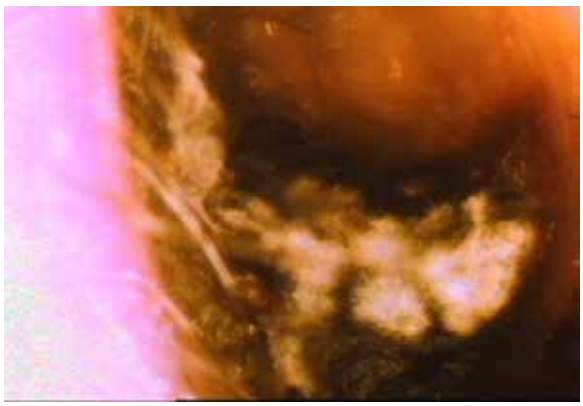

Figure 2: A Grade 2 Otomycosis with Aspergillus colonies filling up almost half of External auditory canal.

Treatment methodology

Patients were randomly treated with Oral Itraconazole or

1. Removal of fungal debris on the first visit using Suction or gentle ear irrigation under Endoscope or Microscope guidance
2. Topical Clotrimazole ear drops 5 drops twice a day for all patients. No oral medicines for Control wing.
3. Cap Itraconazole at 200mg Once a day for 5 days for trial group.

Observations

Ear swab was cultured on Sabouraud's dextrose agar, growth was stained and observed to identify the fungal pathogen, and fungal species profile that was observed is as follows in the figure 1.

Most common fungus isolated was Aspergillus niger , fumigatus and flavus 73% of cases, Candida albicans/ pseudotropicalis /tropicalis was found in 22% of cases, other miscellaneous fungi like Mucor, Alternaria, Fusarium 5% cases.

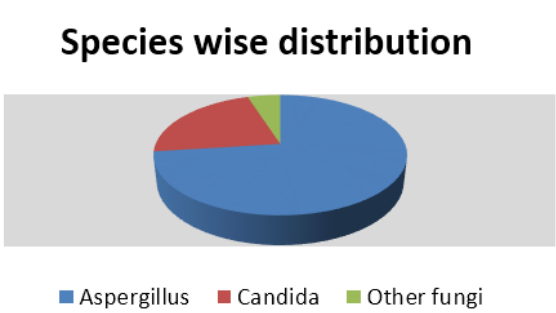

Figure 3: Species wise distribution of pathogen

RANDOMIZATION of treatment

Using a simple random number table participants were assigned study group or Control group. Patients were the not blinded as they were passive, the grading doctors were blinded and did not know which group patient belonged when estimating the clinical grade of Otomycosis. The effectiveness of the therapy was tested by Bio-statistical methods.

Figure 4 Candida species growing with curd white (yeast) colonies on Sabouraud's dextrose agar from ear swab of a case

Adverse effects

No serious adverse effects were seen on using Cap Itraconazole at 200mg Once a day for 5 days, though a subset of patients did complaint of nausea following ingestion of capsule. This was fortunately a small cohort comprising of 3 out 15.

Effect on Itching symptom

All the treatment limb patients had remarkable relief from itching which was one of their most troublesome symptoms on first presenting to our clinic.

Biostatistic analysis of Randomized control trail results

Simple Analysis of data was done using statistical test. Since the trail uses grading to measure outcomes, this qualifies as nominal data and hence we had to use Non-Parametric statistical test for analysis of the trail data.

Kolmogorov–Smirnov was employed to test and ascertain normality of data. For sample sizes of 20, approximation using the normal distribution is fairly good.

Null hypothesis is that treatment has not made any difference and since failure and cure are possible 50% times (Equally possible if solely by chance p=q=0.5). Setting up variables

Null hypothesis H0: E(X) = There is no difference in cure rates in either limbs of study (median difference between the pairs is zero)

Alternate Hypothesis: Ha: E(X) =Itraconazole has produced a significant difference in cure rate. (median difference is not zero)

We used Non-parametric Wilcoxon-Mann-Whitneys test and Median Test to find the p Value which was computed to N1=15(Trail) N2=5(Control), the computed U value based on grading 0-5 and ranked was found to be

U=11 (Table value at p=0.05 Significance N1=15 and N2=5 is 14)

Our obtained U of 11 is less than this, and so we conclude that there is significant (95%) difference between our two groups and we reject the null hypothesis and agree that the treatment has made a significant impact.

Discussion

Andrall and Gaverret were the first ascribe this infection of the ear to fungal pathogen (Rafique R and Udaipurwala 2014) Recurrence and recidivism are a common phenomenon in Otomycosis in Diabetic patients (Vennewald I, Klemm 2009).

The following are predisposing factors identified for causation of Otomycosis.

TABLE – 2
Predisposing factor for Otomycosis

Predisposing factors described in literature
1.Absence of wax
2.Hot and humid climatic conditions
3.Use of systemic or topical antibiotics and steroids
4.Use of occlusive hearing aids or dress
5.Previous mastoid surgeries
6.Immuno-compromised condition like HIV
7.2nd and 3rd decades of life
8.Lower socioeconomic status keeping poor hygiene
9.Instillation of oil (Haja Abdul N & Shaik K M 2015

Aspergillus genus or yeast-like fungi, particularly Candida spp are known to inhabit the External Auditory canal EAC as commensals (Murray P. A 1995). This flora is non pathogenic as long some predisposing factor does not reduce immunity and bring about a fungal infection. So the treatment has to be vigorously directed towards management of the predisposing factor. In Diabetics it is particularly difficult to control the infection there is where Oral anti-fungal with a broad spectrum of activity comes into picture.

Role of Oral Anti-fungal in Recurrent cases

Fluconazole is a first-generation triazole anti-fungal drug which has high activity against Candida species (Except species Candida krusei or glabrata) and some Dermidaceous fungi but is quite ineffective against Aspergillus. Though Fluconazole can be used and does have a high safety profile, Oral Fluconazole can be used in patients culture proven Candida (Susceptible species).

Itraconazole has a broad spectrum of activity than Fluconazole and is effective specifically against the most common pathogen Aspergillus(Gilbert DN 2006). Itraconazole cannot be used for deep CNS infections as it does not have any CSF penetration. Itraconazole also is being clinically trailed as an adjunct Chemotherapy agent for Non Small cell carcinoma of lungs (Aftab BT & Dobromilskaya 2010).

The following adverse effects are seen with the use of Itraconazole

1. Elevated liver enzyme due to Hepatocellular damage and Acute liver failure. (Serious adverse effect)
2. Congestive cardiac failure CCF can be precipitated and Acute Cardiac failure (Serious adverse effect)
3. Other adverse effect are Sensori-neural hearing loss, Neuropathy, loss of libido, depression, palpitations, fever, chills, or sore throat, hair loss, increased or uncontrolled urination ,joint pain, loss of appetite, myalgia, fatigue, weakness, or cramping, numbness, burning, or tingling of the hands, arms, legs, or feet, pain, redness, or swelling at the injection site, pale stools etc
4. Minor adverse effects are Diarrhea, dizziness, abdominal distension, headache, nausea, abdominal pain and vomiting.

In our study we did not experience any serious adverse effects, only minor Gastrointestinal upset Nausea and abdominal distension were reported by few patients. In fact a majority of patients reported a remarkable relief from itching which was one of their most troublesome symptom on first presenting to our clinic.

Conclusions

1. The predominant agent fungus was Aspergillus niger in most of the cases.
2. Cap Itraconazole 200md OD given for 5 days is a very effe tive therapy for Recurrent Otomycosis in Diabetic patients
3. A short course of Oral broad spectrum Anti-fungal is very effective in management of troublesome Otomycosis.
4. Early intensive management in Diabetic patients prevents Malignant Otitis externa.
5. Pruritis is also much reduced after using Cap Itraconazole.

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BILATERAL PERICHONDRITIS OF PINNA FOLLOWING PIERCING OF HELIX – A CASE REPORT

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Abstract

Piercing of Helix of pinna is a social custom of certain communities in Northern Tamil Nadu. Such a "high helical" piercing is well known to cause Perichondritis of Pinna. Most of the times such a Perichondritis is unilateral. Here we present a case of Bilateral Perichondritis of pinna, following ear piercing, first time from India subcontinent. We also highlight some practical points on management of such cases.

Case Report

An adolescent girl presented to SLIMS, ENT out Patient Clinic with history of pain and swelling in both ears since 15 days, she revealed that she had undergone ear piercing by a village elder. Her parents had arranged for this as she was nearing her marriageable age. She told that is was custom of

womenfolk in her community to have the helix pierced, in addition to usual lobular piercing practiced everywhere. A rusted nail was used for piercing the helix, after which Calatropis [called *erukan/ Kalli chedi- Tamil Milky/resinous weed]* twig was inserted into the helical aperture thus made. She did not give any history suggestive of Diabetes mellitus.

On examination she was afebrile and swellings of helices of both pinnae was noted,[Fig 1] with multiple discharging sinuses on the posterior aspect of both pinnae.[Figure 2 and 3]

Swabs from the draining sinuses were sent for Gram stain, Culture and sensitivity. Debridment and cleaning in our Septic operation theater was done. Tentatively patient was put on intravenous Cefotaxime and Metronidazole. Culture report was obtained after 3 days, showed growth of Staphylococcus aureus, from both ears, which was sensitive to Amikacin and Cefotaxime. Biopsy of the sinus revealed non specific inflammation with polymorphic infiltrate of the tissue. Daily cleaning and dressing was done with Soframycin. A second time debridement was done at 1 week. After 8 days of Intravenous antibiotics patient was discharged. Patient is under follow up till date, 3 months ,and has thickening and scarification of Pinna cartilage as a deformity.

Discussion

Perichondritis of Auricle is a serious infection which can rapidly destroy the cartilage and cause deformity.(Ref 1) Piercing of Helix of Pinna is a social custom of certain communities in Northern Tamil Nadu. Such a "high helical" piercing is well known to cause Perichondritis of Pinna. (1) Most of the time such a Perichondritis is unilateral. (2) A literature search in Pubmed [http://www.ncbi.nlm.nih.gov/] did not reveal any reported case of Bilateral Perichondritis of Pinna following high ear piercing.

Most of the papers on ear piercing are from South America,(4) this is the first paper on Bilateral Perichondritis from India. Bilateral Perichondritis has been reported only in Diabetics (3). Majority of the cosmetic piercing is done on Lobule which carries no risk of Perichondritis. "High helical Cosmetic" piercing has high risk of developing infection because of violation of the cartilage, stripping of the Perichondrium, avascular necrosis of the devascularized cartilage, finally neo

cartilage formation leading to cauliflower ear or lop ear deformity. (4) In addition such a procedure is carried out using septic instruments like rusted nail. Wound is cleaned using milk of poisonous Calatropis plant [kalli / erukan chedi], which is believed to have medicinal properties. This is compounded by peer pressure and social compulsion of marriage.

Most frequent organism isolated, as reported in western literature, in such cases is Pseudomonas, lesser extent Staphylococcus, since the host factors are different in India.(1,5) Staphylococcus seems to be the most common agent responsible for the infection, as predicted by similar cases presenting to us. This remains to be followed up in sequential studies.

Conclusion

Perichondritis of Pinna is common following trauma, this can be surgical or accidental. Staphylococcus seems to be the common bacteriological agent responsible for Perichondritis of Pinna due to high helical cosmetic piercing

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AETIOLOGY OF SUBACUTE COUGH IN PATIENTS PRESENTING AT SLIMS ENT OUTPATIENT CLINIC – A CLINICAL STUDY

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Abstract
Cough is one of the most common complaint of patients seeking medical attention. A number of patients attend our OPD for complaint of Subacute cough lasting 3-8 weeks. Majority of such cough are due to ENT pathologies. This study aims to evaluate the Otolaryngological causes of Cough in these patients.

Keywords
Cough, Acute Cough, Chronic Cough, Sub acute cough, GERD, Chronic pharyngitis, Allergic cough, Reflux related, Asthmatic cough, Bronchitis, Post infectious, Non Post infectious

Introduction

Cough is a protective airway reflex. A well known aphorism, that larynx is the "*watch dog of lungs*" refers to cough reflex that is triggered when ever any foreign object enters the air way. Stroke impairs the cough reflexes and predisposes to aspiration. Cough becomes a problem when it becomes a nuisance to the patient and causes social embarrassment or fatigue. Many a mutiparous women also suffer from urinary incontinence as a result of cough.

Aims and Objectives

1. To evaluate the causative factor for subacute cough, cough lasting 3-8 weeks
2. To categorize the class of patient who have specific ENT pathology as a cause of cough

Materials and Methods

The present study was done in ENT Out-Patient Clinic of Sri Lakshmi Narayana Institute of Medical Sciences. A total of 100 patients were selected from the pool of OPD attendees, who came to our center from 1st October 2012 to 15th November 2012.

A questionnaire was circulated among the interns and residents of ENT, General Medicine departments, which was targeted our candidate patients. Detailed history was taken, and ENT and

chest was evaluated. Chest X ray, ECG, 70 degree Rigid Laryngoscopy, Sputum smear examination was done on all cases, with Flexible fibreoptic Upper GI-Scopy, X Ray PNS water's view, CT PNS, Barium swallow-meal, Throat swab and CT Chest for diagnosis, reserved for suspected cases like Acute Sinusitis, Lung malignancy, Vocal Cord palsy.

Patient Selection Criteria

1. History of Subacute cough – 3 to 8 weeks
2. No obvious cause like Tuberculosis (Any history of T.B or Sputum smear positives were excluded)
3. Patient's age less than 14 years, and more than 65 years, as this study focus on Adult population neither pediatric nor geriatric group
4. Any History or Laboratory evidence of Immuno-suppression like Diabetes or HIV as aetiopathogenesis of such cases is likely to be different.

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5. With history of smoking and chronic cough were excluded from this study as most of these are cases of acute exacerbation of chronic bronchitis, again a non ENT problem.

Observations

Cause of Cough

An attempt was made to identify the cause of cough in every patient. Of the 100 patients examined the most common identifiable cause of Subacute (3-8 week) cough was found to be Post-viral infection Sinusitis and a persistent post nasal drip leading to cough. The second major cause of cough found was Gastro-oesophageal Reflux Disease. The findings are tabulated under Table-1
A fraction of case did not have any evident cause of cough.

Table1

S.No	Cause of Subacute Cough	Total 100	Total %	Male 45	Males %	Female 55	Female %
1.	Acute/ Subacute Sinusitis	34	34%	15	33%	19	34.5%
2.	GERD Related	25	25%	10	22%	15	27.3%
3.	Allergic Cough / Asthmatic history	9	9%	5	11%	4	7.3%
	Upper Airway Cough Syndrome PND + Throat symptoms	6	6%	2	4.4%	4	7.3%
4.	Acute/ Chronic pharyngitis	3	3%	2	4.4%	1	1.8%
5.	Chronic laryngitis	1	1%	0	0	1	1.8%
7.	Occupational cough	1	1%	1	2.2%	0	0
8.	No cause identified	21	21%	10	23%	11	20%

Predisposing factors identified in the clinical evaluation of the cohort of cases is illustrated as below

Table2.

S.No	Predisposing factors for Subacute Cough	+ive responders In a Total 100	+ive responders Percentage no of pts %	+ive responders Male 45	+ive responders Males %	+ive responders Female 55	+ive responders Female %
1.	Previous Cold/ Coryza	39	39%	20	44.4%	19	34.5%
2.	Influenza/ Flu/ Viral fever	24	24%	10	22.2%	14	25.5%
3.	HISTORY Spicy food intake (GERD)	44	44%	23	51.1%	21	38.2%
4.	HISTORY Reflux / Regurgitation / Belching (GERD)	25	25%	9	20%	16	29.1%
5.	Occupational exposure to allergens like farmers / industry/ construction workers (Allergic)	16%	16%	9	20%	7	12.7%
6.	HISTORY Pets / cattle at home (Allergic)	19	19%	8	17.8%	11	20%
7.	HISTORY Smoking + Subacute cough	15	15%	15	33.3%	0	0%
8.	HISTORY Alcohol use (GERD)	11	11%	11	24.4%	0	0%
9.	HISTORY Self medications / Native medicine	12	12%	7	15.6%	5	9.1%
10.	HISTORY any drug intake like ACE inhibitor	0	0%	0	0%	0	0%

As seen in the table the commonest predisposing factor appears to be a previous history of Cold or Coryza, and a history of viral fever. Influenza or Viral fever was prevalent in Puducherry state, during the winter months of 2012. A large percentage of responders also gave positive history of ingesting spicy foods. The exact contribution of this to the burden of cough remains to be seen. GERD was also found to be a common factor leading to subacute cough. Positive history of Occupational exposure to allergens like farmers / industry/ construction workers was also found in a fraction of patient. Likewise keeping a pet animal at home also seems to contribute to Subacute cough.

Discussion

Questionnaire identified patients with subacute cough as history evidence of cough lasting 3 to 8 weeks. History was also obtained for Symptoms of Sinusitis like Headache, Nose block, purulent nasal drip, Post-nasal drip, Cough increased at night, Bad odor in nose and Facial pain. Allergic history was inquired and any History of Sneezing, Itching, watering from nose, watery discharge from nose. Asthma was detected by history of Wheezing, Cough at night etc (1).

Chest X ray done in all patients ruled out Lung causes of Subacute cough like Pneumonia and tuberculosis. Pertusis infection, Whooping cough as a cause of subacute cough has been discussed in many literature. Pertusis is per se rare in adults in India, and as many studies point out laboratory diagnosis of Pertusis is difficult, because of time lapse between onset of disease and cough. Throat swabs become negative by the time cough sets in. (3)

The main culprit identified was Post viral infection Sinusitis leading to Post-nasal drip, facial pain, purulent nasal discharge and cough. This seems to be a common problem following episodes of common cold and viral (Flu) fever. Allergy seems to predispose development of sinusitis by prior congestion and oedema of Osteo-meatal unit. (4)

Gastro-oesophageal Reflux Disease is the second most common causative factor. Diagnosis is established by History and Endoscopic examination. Regression of cough and symptoms of acid reflux, regurgitation and belching with Proton Pump Inhibitors (PPI) and Prokinetics was taken to be a successful diagnostic criterion for GERD. (1)

Pure allergic cough was diagnosed in cases with positive history and examination features of Allergic Rhino sinusitis like Bluish hue and pallor of mucosa, Mulberry turbinates, Allergic muco-pus on endoscopy and Bilateral haziness in X ray PNS. Allergic pathology patients were treated with Antihistamines, Decongestants and Steroid sprays. (4)

Upper Airway Cough syndrome is a new entity where the cough is due to direct stimulation and irritation of larynx and pharynx. These set of patients have Post-nasal drip (Major criteria), Throat clearing (Second criteria) and throat congestion but no other clear evidence of Sinusitis. Current literature is unclear on the specific feature of this novel condition. (1) (7)

Pharyngitis was diagnosed on Clinical examination like congestion, granular, cobblestone pharyngeal wall etc and treated with Penicillin, Anti reflux medication and topical lozenges for cough.(1)

When patient gave strong history of Occupational exposure to dust / chemicals, with feature suggestive of Allergic manifestation, a diagnosis of Occupational cough was made, this was confirmed by clinical improvement of patient when they were away from work.(4)

In this study, Acute Bronchitis is a diagnosis of exclusion, should fit into the no cause identified column, excluding Pneumonia (Chest X ray and Fever) and acute asthma (Wheezing, Lung examination). Acute Bronchitis is medical problem outside ENT. (8)

Studies reveal that cough can have a variety of negative impact on life of the sufferers, main complication of cough include Pneumothorax, Laryngeal trauma, Lung herniation, Syncope, Arrhythmia, Splenic rupture, Hernia, Urinary incontinence, Rib fracture, Seizures, Headache, CSF rhinorrhea, petichiae and social embarrassment.
Once the cause is identifiable, targeted pharmacological therapy can allay the suffering of the

patients of subacute cough.

Conclusion

This study is a reminder to the clinician of the most common cause of subacute cough in patients presenting in ENT clinic. Clinical suspicion of most common causes can lead to appropriate and early treatment for the benefit of our patients.

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Variations in the External Auditory Canal of 185 Adult Individuals: A Clinico-Morphological Study

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Abstract- There is number of variations in the morphology of the External Auditory Canal which influence the ability to examine the canal and also play a role in pathogenesis of many Ear diseases. Broadly the aperture of the External Auditory canal is classified into "Narrow" and "Broad" canals. The natural self cleansing ability of the Ear canal may be affected in narrow canals, which could predispose to pathology. This study aims to classify and highlight the variations in ear canal anatomy in a cohort of 185 young adults.

Index Terms- External auditory canal, Anatomy, Aperture, Opening, Narrow, Broad, Tortuous

I. Introduction

The External auditory canal is a blind skin lined sac. The canal is developed from recanalization of the Meatal plate in embryo. This recanalization process is variable and may produce variations in the morphology of the External Auditory canal. This study attempts to classify the morphology of External auditory canal in a subset of 185 normal disease free adult individuals.

II. Materials and Methods

A total of 207 normal healthy persons belonging to the age group 19 to 25 years were chosen.

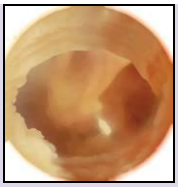
Inclusion criteria

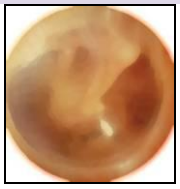
1. Average adult male or female of age between 19 to 25 years
2. No previous history of any ear complaints like ear discharge, hard of hearing, swelling in the ear
3. Consenting to be included in the study
4. Subjects with wax in both ears were excluded from this study.

Grading of the External Auditory canal

The following table represents Morphological Grading of the External Auditory canal, which was created for the purpose of this study.

Table 1: Morphological (Working) classification of the External Auditory Canal

Tentative SLIMS Grading	Appearance on Headlight / Torch examination	Classification in Broad Terminology	Schematic Image
0	No part of canal seen. Soft tissue filling up the External Auditory canal	Ear canal – Atresia	
1	Outer one third – hairs only seen or no aperture seen	Narrow	
2	Outer one-third Aperture of ear canal seen beyond the hairs	Narrow	
3	Inner two-third of canal seen, and/or part of Annulus of Tympanic membrane seen	Intermed-iate	
4	Part of Pars Tensa and handle of Malleus is seen with light reflex, Pars flaccid is not seen	Broad	

5	Tympanic membrane fully seen. Handle of Malleus, Light reflex and pars flaccida easily visible.	Broad	

All grading was done with an immediate appearance on Headlight or Torch, with minimum pull upwards, backwards and laterally. Outer one third of External Auditory canal was identified by the presence of hairs and thicker skin. Inner one third was identified by thinner skin and absence of hairs. Otoscope or speculum or Endoscope was not used in this study as these magnify and distort the natural orientation and anatomy of the Ear canal which is the highlight of this paper.

III Observations

A total of 22 subjects were excluded from the study.11 subjects, (3 males and 8 females) had significant variations in the morphology of the canal between the two ears i.e. more than 2 grades. This was deemed due to some pathology like previous Otitis externa or Scarification etc hence were excluded from our study.

In addition 11 subjects, (3 males and 8 females) had bilateral asymptomatic wax occluding both the ear canals, which precluded the grading of such canals. In our study incidence of bilateral wax was thus (11 out of 207 examined) 5.3% of normal population. Wax is more common in females than males. This shows a value less than previous studies which rate wax from 7 to 35 percentages but unlike our research, the given referenced studies includes Pediatric population [Ref 1]. This perhaps, explains the lower percentage incidence which was found in our study.

The outcomes of the study are depicted in the graphs that follow.

Percentage incidence of various types

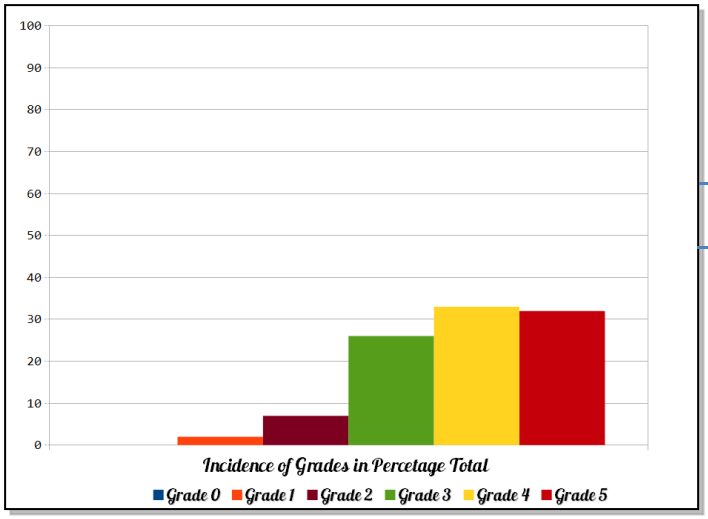


Figure 1: Percentage incidence of various morphological grades of External Auditory canals in Normal individuals

As it can be inferred from graph above that the most common Grade of External Auditory canal was Grade 4 (Broad). This was closely followed by Grade 5 (Broad). Together these two broad types were found in 65% of the individuals. Intermediate grade 3 was found in 26% of individuals, while Narrow variants are rare in occurrences, with a least value of 9%.

Sex wise distribution of types

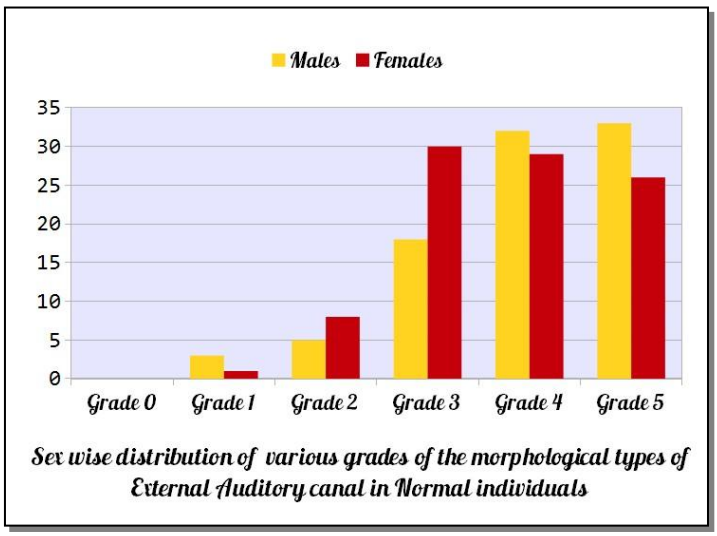


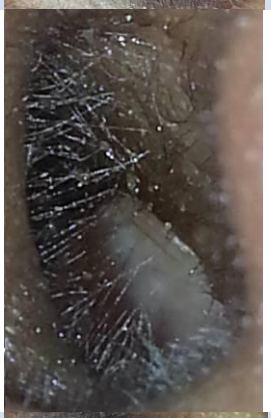
Figure 2: Sex wise incidence of the various grades of the morphological types of External Auditory canal in Normal individuals

It can be inferred from the graph given above, that majority of the External Auditory canals in both males and females are broad, 65% (120/185). Grade 3 Intermediate canal seems to be significantly more common in females in comparison to males.

Narrow canals are quite rare per se (only 9%) and Grade 2 narrow canals seem to be more common in females, though the number of samples in these two categories is too small for a significant conclusion (n< 30).

Table 2: Classification of the External Auditory Canal – Photographic illustration of the types

Grade and explanation	Clinical Photograph

1 **Hairs only seen or no aperture visible, even on manipulation of Pinna (narrow canal)**	
2 **Outer one-third Aperture of ear canal seen beyond the hairs**	
3 **Inner two-third of canal seen, and/or part of Annulus of Tympanic membrane can be seen**	
4 **Part of Pars Tensa and handle of Malleus is seen with light reflex, Pars flaccida is not seen**	
5 **Tympanic membrane fully seen Handle of Malleus, pars flaccida and Light reflex, Anterior process of Malleus is easily seen here**	

IV Discussion

Relevant anatomy and physiology of the External Auditory canal

External Auditory canal develops from the groove of first Branchial arch. This groove deepens and meets the Tubo-tympanic recess of the Endoderm and Mesoderm contributes from the sides. The plate of tissue thus formed is called a Meatal plug. This recanalizes and the External Auditory canal is formed. This in-utero recanalization process has a variable outcome and may produce a variation in the lumen of the External Auditory canal. Plus during the course of development, the External Auditory canal descends downward creating further angulations of the canal [(Ref 3)].

Tympanic bone with its soft tissue cover forms the External Auditory canal. Tympanic bone connects to the mastoid part via tympanomastoid sutures and with squamous part via the tympanosquamous suture line. Spinous process is projection of this suture line into the ear canal. Tympanic bone forms the posterior part of Glenoid fossa. Anterior Glenoid fossa encroaches on the lumen of the External Auditory canal and creates a variable degree of narrowing of the ear canal [(Ref 8)]. Tympanic bone is major contributor to shape and orientation of the External Auditory canal [(Ref 15)].

External Auditory canal is a skin lined blind bag. Natural skin of the External Auditory canal has tendency to migrate outward as it matures. Wax or Cerumen rides on the tip of the hairs to migrate outwards [(Ref 6)]. This causes self cleansing of the canal and prevents the ear from completely filling up with the skin and debris [(Ref 10)].

External Auditory canal consists of outer one-third made of cartilage and an inner two-thirds made of bone. There are no Rete pegs (dermal papillae) hence it closely attaches to the outer cartilaginous and inner bony part of the External Auditory canal. The subcutaneous tissue of the cartilaginous part is thick and contributes the bulk of the External Auditory canal. External Auditory canal has a tortuous "S" shaped course in which it first travels inward, anterior and superiorly *(pars externa)*, then inwards, posterior and superiorly *(pars media)* and then finally, anterior and inferiorly *(pars interna)* [(Ref 5)]. In order to visualize the Ear canal one has to pull upwards, backwards [(Ref 6)].

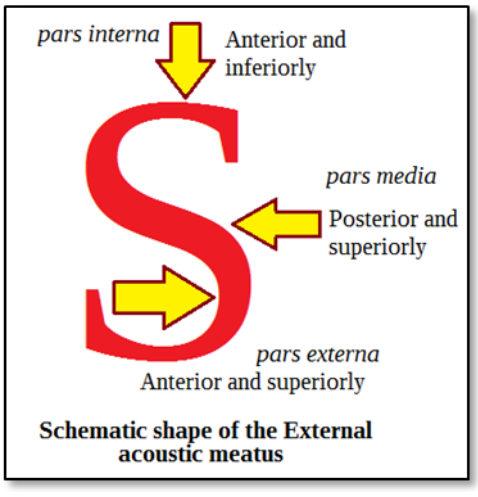


Figure 3: Schematic shape of the External Auditory canal

Hairs are present only in the outer one-third of the External Auditory Canal and their absence helps to distinguish the bony from cartilage part of the External auditory canal. This difference is capitalized in our classification of types of the External Auditory canal.

Blood Supply to External Auditory canal [Ref 14]

Cartilaginous part derives blood supply from: 1.Superficial temporal artery and 2. Posterior auricular artery, bony part derives blood supply from Deep auricular branch of the Maxillary artery. Lymphatics drain into the Preauricular and Postauricular Lymph nodes.

This study *in principio* attempts to classify aperture, orientation and soft tissue cover thickness of the External Auditory canal.

Pathological conditions related to morphology Canal wall

The angulation of the Ear canal is related to a few pathological condition of the Temporal bone. For instance, in Keratosis obturans there is impaired migration of the External Auditory canal skin and subsequent impaction and widening of the bony part of the canal [Ref 7]. This condition is usually bilateral strengthening our theory that it is an abnormal anatomy of the External Auditory canal, which predisposes to the development of this disease. Narrow recesses in the ear canal may lead to entrapment of the skin in the posterior-inferior portion of the bony external auditory canal and Cholesteatoma formation [Ref 9].

Likewise, foreign body impaction is more common in narrow ears. Otitis externa and Otomycosis occurs due to excessive sweating and accumulation of moisture which is more common in narrow canals (type 1 and 2). In Malignant Otitis externa, the initial infection is confined to the skin and soft tissues of the ear canal and further progress to skull base may be determined by the thickness and orientation of the External Auditory Canal [Ref 11].

External auditory Exostosis occurs frequently in swimmers, as the splashing of cold water inside the canal causes development of bony spicules. [Ref 12] Exostosis may be related to a broad canal wall (type 4 or 5) which would predispose to development of this condition.

Benign necrotizing Otitis externa is necrosis of the skin and superficial bone may be more common in broad ears with a thinner soft tissue cover (grade 4 or 5) [Ref 13].

Clinical uses of this classification

Endaural incision and Intra-canal procedures need a broad ear canal, as the whole instrumentation has to be done into the canal [Ref 2]. Our study will help the clinicians in classifying the cases fit for Endaural versus post-auricular access methods. Types 5, 4 and 3 would be more suited for the Endaural procedures.

V Conclusion

There are variations in canalization of the embryological Meatal plug, resulting in a variety of morphological types of External Auditory canals. Most common types are Grade 4 and 5 Broad ear canals. Asymptomatic bilateral wax was found in 5.3% of the total subjects. There seems to be a relationship between type of ear canal and diseases of External ear. This association needs to be elucidated by further studies correlating External Auditory canal grades we have propounded, with actual disease patterns.

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Original Article

Star weed *(Parthenium hysterophorus)* allergy in Allergic Rhinosinusitis patients as determined by Skin Prick test

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ABSTRACT

Star weed is herbaceous plant growing freely in whole of Indian country side. This plant produces large quantities of white pollen, which many people are allergic to. This study seeks to examine the prevalence of Star weed *(Parthenium hysterophorus)* allergy in a subset of Allergic Rhinosinusitis patients who attend ENT Clinic, as determined by a Skin Prick test.

1. Introduction

Star weed *(Parthenium hysterophorus)* is a ubiquitous weed growing freely in Indian countryside and road side. (10) Many people have become sensitized and allergic to the copious amounts of white pollen regularly produced and aerogenically released by this plant. In addition it also produces a toxin "parthenin" which leads to Contact dermatitis in humans and cattle. (8) The association between the pollen of this plant and Allergic rhinitis has not been studied in India.

2. Materials and Methods

Preparation of "Standardized antigen concentrate"

An aqueous extract of Star weed *(Parthenium hysterophorus)* white pollen was used for performing the skin prick test. This was prepared by mixing 300grams of pollen to 1 liter of distilled water. This solution was then homogenized by gently heating for 10 minutes at 80 degree Celsius. This was the

"Standardized antigen concentrate". (9) This was diluted to 1:20 times weight per volume and used for Skin prick test.

Patient criteria

Patients were selected for the test, by a questionnaire for screening subset of cases who were suffering from Allergic Rhinosinusitis. Clinical evaluation was done in all selected cases.

Age less than 14 years and more than 65 years were excluded from the study. Due to risky nature of the test, following cases were excluded from testing.

1. Patients who took Beta-blockers were totally excluded from study.

2. All hypertensive patients were checked Blood pressure twice to ascertain normalcy, before proceeding to test.

3. Heart disease patients were completely excluded from study.

4. Diabetes and Immuno-suppressed were excluded, due risk from skin prick.

Testing precaution

Emergency resuscitation equipment was kept ready to revive the patient in case of Anaphylactic shock from Skin prick test. Adrenaline, Hydrocortisone, Anti Histamines, Intravenous access devices, and emergency resuscitation equipment. (9)

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1. In order to establish standardization test, female patients' comfort and ease of reading the outcome, this Test was done only on volar surface of forearm; other parts like thigh and upper back were avoided

2. A small drop of Antigen concentrate was placed on the skin. A regular 24 gauge hypodermic needle was used to "tent up" or elevate the skin via the drop of antigen, taking care to avoid bleeding of puncture of the deeper subcutaneous layer or the dermis.

3. Response was checked after 20 minutes.

4. Dip method of testing where antigen is picked up on tip of needle, was not used. Glycerination of Antigen concentrate deemed necessary was found to be cumbersome, hence avoided.

5. Tested area was kept immobile for 20 minutes.

6. Negative control was a 10% solution of glycerin.

Fig 1. A flare reaction to Skin prick antigen test- Negative Skin Prick test

Fig 2. A wheal response more than 3mm

Outcome of the test

1. Positive - A wheal response more than 3mm in size, after 20 minutes was considered positive.

2. Negative - No response at the test site. Flare / Congestion was taken as negative

Results

The outcome of the test is tabulated in the following table

Table 1 : Outcomes of the Skin prick test for Parthenium hysterophorus pollen allergy

Operative findings	Allergic Rhino sinusitis	Normal ENT patients	Total
Test positive >3mm wheal	67	51	98
Test negative <3 mm wheal Flare	33	49	102
	100	100	200Chi sq =5.291 >>> 3.841 at P value 5% significance

Statistical check

A chi square test was set up with null hypothesis [H0] that, there is no difference in observed positive response between Allergic Rhinosinusitis patient and normal patient. Chi square test was validated without Yates correction because none of the cell has a value less than 4. The standard chi square test was found to give a value of 5.291.The test has a 1 X 1 degree of freedom; the P value of at 5% (0.05) significance, given in table is 3.841, which is greater than study Chi square value. This difference has not arisen out of a statistical error, and there is a statistically significant association between Allergic Rhinosinusitis and Star weed allergy.

Discussion

Allergic Rhino sinusitis is triggered by a variety of factors in day today use. Most people are allergic to House-mites, animal dander or food colorants. Parthenium hysterophorus is an herbaceous weed growing freely in Indian countryside. It belongs to the family Compositae and a native of tropical zones of America (7).It is commonly known in Hindi as "Gajar Ghas" meaning Carrot grass. Author has personally seen the weed in most of the Indian states. The flowering season of the weed peaks around January – March where copious amounts of pollen are released. Most of the people get exposed to this pollen, become Immuno-sensitized then develop an immune reaction to the proteins in the pollen.

Fig 3 and 4 Parthenium hysterophorus- a herbaceous weed found growing freely in Indian Countryside, Fig 4 : This shows the star shaped white inflorescence which gets its name. shows star shaped flower from which it gets its name – Star weed

Parthenium is a major contributor in the suffering of Allergic Rhinosinusitis patients. Since there is a single airway from nose to alveoli, it is also likely to have a hand in the pathogenesis of Asthma. This remains to be studied. Eradication of the weed may offer some respite in sufferers of Hay fever and Asthma.

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Case Report
Biological Sciences

SPONTANEOUS RUPTURE OF FACIAL ARTERY DUE TO BUCCAL MALIGNANT EROSION AND MANAGEMENT: A CASE REPORT

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ABSTRACT

In this compilation we report Carcinoma Left Buccal region (cheek) which presented as spontaneous, sudden rupture of the facial artery and spreading hematoma of the left half of the face. Further expansion of the hematoma was checked by immediate compression on the inferior border of body of Mandible. Hematoma resolved with conservative management and the patient underwent a resection and pedicle forehead flap reconstruction of the defect. This was followed by Radiotherapy for the node and the primary lesion.

KEY WORDS

Facial Artery, Malignant erosion, Cancer, Cheek

INTRODUCTION

Malignant erosion of a major artery is the terminal fate of many a Cancer patients. Erosion of Aorta, Internal Carotid Artery and External carotid artery has been described in the literature. Here we describe an unusual case of malignant erosion of the Facial artery leading to spontaneous rupture, facial hematoma and its subsequent management.

CASE HISTORY

47 year old Mr. Rg presented to our E.N.T Outpatient clinic with a history of swelling of Cheek and redness of cheek since morning. The swelling and redness suddenly developed while he was attending his morning ablutions. The swelling was progressive in size. He also gave history of Pain and ulcer in the cheek. Mr. Rg was a smoker and betel nut chewer by habit and he occasionally took liquor. He had the habit of keeping the betel quid laced with slaked lime *(= Tamil Chunnamb)* in the left cheek. He did not have any other medical illness.

On Examination we found a large hematoma occupying roughly whole of the mid one third of left half of the face. The swelling was tense in consistency, red in colour and pulsatile to touch. There was severe tenderness. Muscles of mastication were unaffected, so trismus was absent. [6] On examination of mouth it was found to contain a malignant, proliferative growth filling up the Left Buccal mucosa extending from the upper alveolar margin to the lower alveolar margin. Posteriorly the growth extended till the retro molar trigone. Surface was irregular. A 4 X1 cm clot was found sticking to the edges of the Buccal mucosa (Refer figure 1) Sub-mental nodes were enlarged 2 cms in size, non tender, firm in consistency and no fixity. [N1 Nodal staging for buccal carcinoma]

Figure 1: Patient showing spreading facial swelling due to sudden malignant rupture of Facial artery (Red arrow). A clot can be seen in the edge of the mouth. (**Green arrow**)

The patient was assigned T4 of American Joint Committee on Cancer Staging of Lip and Oral Cavity Cancer, T.N.M Staging as there was invasion proximal structures. Patient was grouped in Stage IVA as per the staging chart. [7]

Facial artery pulsation was located on inferior surface of body of the mandible and was immediately compressed against bone of the mandible. Compression was done for 10 minutes to ensure no further spread of hematoma.

Venous access was secured and patient was immediately admitted into our E.N.T Intensive care unit. An immediate platelet count, peripheral smear, Bleeding time, clotting time and coagulation profile was checked and found to be normal. Injection Ethamsylate 500 mg four times daily and injection Midazolam 5mg I.M Stat was given. [1] Serratio-peptidase and Trypsin oral formulation were given to reduce the swelling. He was also given one unit of compatible blood transfusion. He was advised to take only liquid diet, abstain from any straining and apply Glycerin Magnesium Sulphate (Glycerin -Magsulf) to reduce the oedema. [4] He underwent an angiogram which showed no further leakage of the dye, hence it was assumed that the rupture had sealed. Embolization was not done. Thus, further expansion of the erosion was checked by conservative management. [1]

One month later the patient underwent an Onco-Surgical evaluation, following which he underwent a resection and tube pedicle flap reconstruction of the defect. He was referred for Radiotherapy for the secondary node. He is under follow up and is disease free till this date.

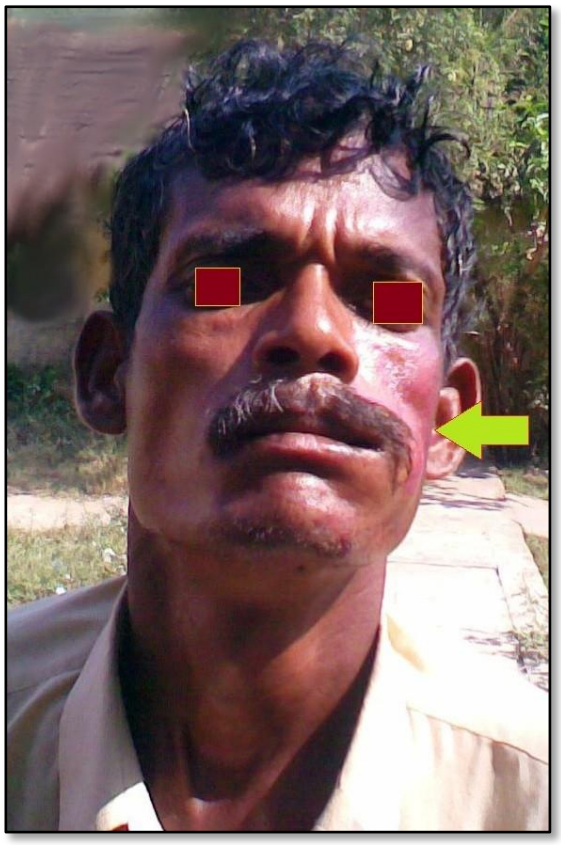

Figure 2: Facial hematoma due to malignant rupture of Facial artery, resolving stage. Green arrow points to resolving hematoma.

Figure 3: Angiogram of the Left facial vein showing no extravasation of contrast media. Rupture sealed with conservative management.

DISCUSSION

Buccal Carcinomas accounts, for around 8% of all oral malignancies. Typically occurs after 60 years of age and is more common in males. [5] In India, use of Betel nut laced with Slaked lime is associated with high risk of developing buccal carcinoma. This habit was found in this case also. [6]

All malignant ulcers have tendency to bleed. This is enhanced by the high vascularity of the tumors. Erosion of major vessels like Carotid is a common terminal event in natural history of head and neck malignancy.[4] This entity has been well reported and documented in literature but malignant rupture Facial artery has not been hitherto reported.

Facial artery and Superficial Temporal artery are the major nutrient supply to the face. Facial artery originates in the neck from the external carotid artery. It enters the face crossing the anteroinferior border of Masseter and inferior surface of body of mandible. Its pulsation can be felt here. It is superficial and lies underneath the Platysma. It is covered by skin and fat of the cheek. It is presumed that the buccal malignancy eroded the Facial artery here. It has a tortuous course making it even more vulnerable to injury. Further, it may pass over or through levator labii superioris. Towards the end it is embedded in levator labii superioris alaequae nasi. Here again it may be prone for rupture due malignant erosion and forcible contraction of the muscle. [3]

CONCLUSION

1. Erosion of the Facial artery is a rare presentation of Malignancy of Oral cavity. This condition has to be thought of in any patient of Oral Buccal or gingival malignancy who presents with sudden onset reddish swelling of the cheek following an episode of straining or coughing. Rapid compression of the Facial artery against the inferior border of bone of Mandible can save the patient from a fatal hemorrhage.

2. Enzymatic preparations like Trypsin (Brand name Rutoheal) seem to be very effective in control of edema and hematoma following malignancy.

Conflicts of interest

I hereby declare that there is no conflict of interest.

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Research Paper Medical Science

Welder's Pharyngitis: Clinical Profile of a New Type of Chronic Occupational-Irritant Pharyngitis

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ABSTRACT

Welding fumes constitute a definite occupational hazard. Chronic indolent Pharyngitis lasting more than 4 weeks is common among the subset of population whose occupation deals with welding fumes. This type of irritant Pharyngitis seems to be a distinct clinical entity. This study aims to spotlight the unique clinical features of Welder's Pharyngitis. Unique clinical features of this entity include "angry red" pharyngeal mucosa, cobble stone like appearance of Posterior pharyngeal wall, hypertrophy of lateral pharyngeal bands, and symptom free "Holiday" periods.

Keywords : Chronic Pharyngitis, hypertrophic granular, Environmental pollution, Chronic irritants, Cough, Occupational disease, Welders, Pharyngeal wall ,Posterior pharyngeal wall, Welder's Pharyngitis, Zinc , Cadmium, Beryllium, Mercury, Nickel, Iron Oxide, Lead oxide, Fluorides, Ozone, Phosgene ,Nitrogen oxides, Organic halogenated compounds

INTRODUCTION

Chronic Pharyngitis is persistent inflammation of Pharynx for more than 4 weeks. Welding fumes contain a variety of noxious chemicals which can initiate and maintain inflammation of pharynx. This study aims to highlight a novel persistent type of Pharyngitis seen in Welding workers.

Type of Study

This was a Descriptive longitudinal epidemiological type of study.

Materials and methods

A total 55 patients visiting our ENT out-patient clinic were selected for the study. The study was carried out from 1 January 2013 to 30 April 2013(4 months) .The patient selection criterion was as follows.

Inclusion criterion

1. Welder by occupation (ref 14)
   Working definition of a welder is a person who engages in welding work more than 8 hours in a day. It was determined if the patient actually was exposed to Welding gases and fumes as a part of their day today work.
2. History of Sore throat, difficulty in swallowing, irritation in the throat, cough, foreign body sensation, bad odor (Cacosmia) in throat lasting more than 4 weeks
3. Oropharyngeal cultures are usually negative for any typical bacteria. (Ref 16, 17)
3. Typically the patients had taken long course of Antibiotics; usually more than 10 days, and a strong case for Welder's Pharyngitis is non response to Antibiotics.

Exclusion criterion

1. Positive culprit pathogen identified by throat culture for instance Group A beta hemolytic *Streptococci*, most common pathogen in Acute and chronic Pharyngitis. This does not include commensals which normally colonize the oropharynx like *Bacteroides Actinomyces, Staphylococcus, Prevotella*, non-hemolytic *Streptococci* and *Lactobacillus*. (Ref 16)
2. Less than 84 weeks sore throat are likely to be infective hence were excluded. Suspicious signs like loss of weight, radiating pain to one side, neck lymph node enlargement, Immuno deficiency were excluded
4. Presence of lymphadenopathy, or hepatosplenomegaly or a grey membrane over tonsils, petechiae on the soft palate (infectious mononucleosis) or fever or ulcerative vesicles (Herpangina) or reflux or evidence of postnasal drip(chronic sinusitis) (Ref 18)
5. Any other causative factor identified like for example presence of chronic tonsillitis: tonsillar crypts, positive squeeze test and the enlargement of Jugulodigastric lymph nodes. (Ref 15, 17)

Smoking habit acts as a carrier of the noxious fumes, hence smokers were not excluded from the study. (18) All the selected patients underwent a Diagnostic Video-endoscopy, Throat swab, Peripheral smear, Blood ASO titer, and complete haemogram. Hospital Ethical committee approval was obtained for the purpose of the study.

Results

Symptoms and signs

The most common clinical presentation of these patients was as follows in table

All the patients gave a history of sore throat and difficulty in swallowing more than 4 weeks in duration(55=100%), most of the patients also suffered from a cough (44/55=80%), cough was typically exacerbated during work. Halitosis and Cacosmia was present in few cases (33%).

Patients also reported a marked improvement in symptoms on weekends and on holidays, (39/55= 71%) implying that it is Welding fume that is the causative agent. Patients experienced a sensation of dryness of throat and metallic taste more in the evenings (23/55=42%). This could be due to cumulative effect of the fumes/ dust during day time.

Figure 1: A typical case of Welder's Pharyngitis showing typical "Angry red" pharynx with Cobble stone appearance of Posterior pharyngeal wall. This patient was a welder by occupation for the past 11 years.

Source: Photographed by the Author

All the cases had congestion and cobble stone like granular posterior pharyngeal wall, (55/55=100%) typical of Irritant and allergic Pharyngitis. In a vast majority of patients the posterior pharyngeal wall was markedly red and angry looking, (51/55=92.7%): this seems to be an important diagnostic criterion. There was associated congestion of tonsillar pillars and uvula in many cases (43/55=78.2%). There was post nasal drip (27/55=49.1%) and features of Allergic Rhinitis in some cases (20/55=36.4%).

Discussion

Pathogenesis of Welder's Pharyngitis

Occupational Pharyngitis has been thought to be due to a Type IV delayed type Hypersensitivity reaction to foreign antigen (T cell reaction) [1]. This is also called Cell-Mediated Hypersensitivity or T cell reaction. Here a subset of Antigen Sensitized T-Helper1 cells release cytokines that activate macrophages or T helper cells which mediate direct cellular damage.[2]

The late consequence of which is formation of a granuloma. The cobble stone appearance of mucosa in Chronic Pharyngitis could represent a spectrum in the pathogenesis of Irritant Allergic Pharyngitis. A variety of chemicals are known to induce DTHC reaction, notably Nickel salts and dyes. [3]

A distinct clinical entity

Group A Beta hemolytic Streptococcus traditionally causes Pharyngitis; this is characterized by acute onset of fever, body pain, sore throat, difficulty in swallowing ear pain and halitosis. Typical signs include inflammation and oedema of Tonsils and posterior pharyngeal wall, neck may reveal swollen, tender Jugulodiagastric lymph node in proximity to angle of Mandible. [16]

Infectious mononucleosis is also a very common causative agent of Pharyngitis. Acute onset of symptoms, presence of petechiae on the soft palate, hepatomegaly, splenomegaly, reddish skin rash, grayish membrane over tonsils and atypical lymphocytes in blood smear: point to Epstein-Barr virus as the typical causative factor. [16]

Chronic non Specific Pharyngitis is a condition where the patient suffers from long duration, discomfort of throat whose severity varies from time to time. Various factors are attributed to this condition like smoking, GERD, environmental pollution, chronic sinusitis, poor oral-dental hygiene and indoor heat. The clinical signs described include hypertrophy of the lateral pharyngeal lymphoid bands, cobble stone appearance of Pharyngeal wall and post nasal drip. [18] There are typically few clinical signs. This disease seems to be a separate condition from the Irritant Occupational/ Welder's Pharyngitis.

This study aims to systematically *exclude* such causes of Pharyngitis, and establish that Occupational Welder's Pharyngitis is an irritant type of Pharyngeal inflammation *distinct* from the traditional *Streptococcal* Pharyngitis.

Welder's Pharyngitis is more of a chronic hypertrophic Pharyngitis, with a negative throat culture. There seems to be a little role for antibiotic use in this disease.

Toxins in Welding fumes

Welding fumes is a cocktail of extremely irritant and immunogenic chemical. Occupational Safety and Health Administration (OSHA) list a number of pathogenic chemicals in welding fumes. These are depicted in the following table. [8]

Many western occupational regulatory agencies like National Institute for Occupational Safety and Health (NIOSH) have established recommended exposure limit (REL) for welding fumes.[4]

Table 1 [Ref 8] Known chemicals in Welding fumes that are pathogenic

S.No	Name of chemical
1.	Toxic metallic fumes like Zinc , Cadmium, Beryllium, Mercury, Nickel, Iron Oxide, Lead oxide
2.	Non metallic inorganic gases like Fluorides, Ozone, Phosgene ,Nitrogen oxides
3.	Organic halogenated compounds like Chlorinated hydrocarbon solvents

American Conference of Governmental Industrial Hygienists (ACGIH) has set a upper limit of 5 milligrams per cubic meter per 8 hour working-day.[5] The known problems caused by welding fumes is illustrated in the table below.

Table 2 Known problems caused by welding fume and gases [Ref 6]

S.No	Diseases
	Pneumonia or Lung infection [7]
	Chronic Obstructive Pulmonary Disease (COPD) [12]
	Occupational asthma[11]
	Cancers like Nasopharyngeal carcinoma [10], Lung cancer
	Metal fume fever
	Temporary reduced lung function[11]
	Irritation of throat and lungs

Outcomes of this study

Irritant Pharyngitis has not been described clearly in any literature, though most of the articles cite welding gases as irritant of the respiratory tree. The unique clinical features of this novel clinical entity are summarized in the following table.

Table 3: Unique Clinical features of Occupational Welder's Pharyngitis

S.NO	Clinical features
	Sore throat / Difficulty in swallowing/ Cough > 4weeks
	Cobble stone appearance of Posterior pharyngeal wall
	Angry red pharynx mucosa = Typical
	Holiday/ weekend symptom free periods
	Dryness / Metallic taste in late afternoon and evenings
	Associated irritant/allergic symptoms like Urticaria, Allergic rhinitis, Asthma, Atopic dermatitis,
	Hypertrophy of the lateral pharyngeal lymphoid bands[18]

	Sore throat / Difficulty in swallowing/ Cough > 4weeks
	Cobble stone appearance of Posterior pharyngeal wall
	Angry red pharynx mucosa = Typical
	Holiday/ weekend symptom free periods
	Dryness / Metallic taste in late afternoon and evenings
	Associated irritant/allergic symptoms like Urticaria, Allergic rhinitis, Asthma, Atopic dermatitis,

Conclusion

Though most of the standard textbooks on otolaryngology like Cummings: Otolaryngology: Head & Neck Surgery, 4th edition [15] and Scott-Brown 's Otorhinolaryngology Head and Neck Surgery 7th edition[18]; mention Environmental exposures and air pollution as cause of Pharyngitis[15], there is very little literature on the clinical features and pathogenesis of Irritant Pharyngitis. This study highlights the unusual clinical features of Welder's Pharyngitis.

Conflict of interest statement

Declaration of Conflict of interest = None

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Recent Trends in Audiology: A Review

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Abstract: ***Audiology the science of Hearing is developing in a rapid pace. The Clinician and Audiologist have a number of modern Audiological tools at their service for easy diagnosis of Ear problems. This Article summarizes some of the relevant developments which will be useful for the Clinician and Scientist. Discussed topics include Otoreflectance Audiometry, Multi Frequency Tympanometry, Fast Spin Echo MRI, Cochlear Hydrops Analysis Masking Procedure and Vestibular Evoked Myogenic Potential***

Keywords: Audiology, Otology, Audiometry, CHAMP, VEMP

1. Introduction

The science of Audiology has progressed leaps and bounds in last few years. The objective of compilation is to introduce and sensitize the Clinicians, Scientists, Audiologists, and Post graduate students of Medicine and E.N.T surgery, the forthcoming and novel diagnostic modalities for detection and quantification of hearing impairment.

This compilation is by no means complete, those topics have chosen, which are believed to be the most useful very recent developments, (not given in textbooks) and put them together in one paper in simple words, for ease of quick perusal.

2. Otoreflectance Audiometry [1]

By Using Classical Impedance Audiometry we indirectly measure the Middle ear Compliance or Impedance using the following formula:

(Impedance) Compliance of Middle ear= Total Compliance - External Auditory canal Compliance.

There is no subtraction in Otoreflectance Audiometry hence it is useful in quick and accurate assessment of Middle and Inner ear status. It uses Acoustic pressure measurement in ear canal using a probe in frequency or time domain over a range of two or more stimulus.

In Otoreflectance Audiometry we simultaneously detect the Middle ear and Inner ear status. Linear Otoreflectance helps us in status of Middle ear. Non linear Otoreflectance uses diffuse High and Low excitation. Non Linear Otoreflectance determines the status of Inner ear. (Ref 1)

3. Multiple/ Multi Frequency Tympanometry [2]

Multi Frequency Tympanometry is essentially same as standard Tympanometry, the only difference is that it uses wide range of frequency that just 255 Hz for "Probe tone frequency" as in Standard Tympanometry. It is claimed to be more sensitive to Middle ear status/ disease in new born and Infants in whom a 225 Hz probe is said to produce erroneous results. Computer Software for analysis of MFT data are now under development.

4. Brain Stem Evoked Response Audiometry (BERA) [3]

Brain Stem Evoked Response Audiometry (BERA) or Auditory Brainstem Evoked Potentials (ABEP); is the measurement of the electrical activity of the Brain stem nucleus and complexes, in response to a sound. A wide band click is used to stimulate all the neural channels of cochlea. As a sound signal travels through the Brain stem and various nucleuses, it generates various waves in the tracing. Changes in the electrical activity of the brain in response to sound stimuli are called "Auditory Evoked Potentials". "Latency" of a wave refers to the time gap between giving the stimulus (Click or Tone burst) and recording of that wave. BERA is recording of the electrical waves currents for the first 10 milliseconds (1/1000 seconds) after stimulus, is called Short Latency Response. (S.L.R). [4]

Table 1: Generators of Waves in BERA) [3]

Wave Number	*Currently Understood Site Of Production*
I	Cochlea
II	Proximal auditory (hearing) nerve end activity
III	Superior olivary complex-Lower pons (Mid brain)
IV and V complex	Lateral lemniscus- Upper pons and junction of midbrain.

4.1 Type and Site of Hearing Loss Objectively Diagnosed [4, 6]

Type of hearing loss and site of lesion can also be detected by specific pattern in BERA. In Conductive hearing loss the Latency is shifted to right by an amount proportional to amount of Conductive hearing loss. In Cochlear High frequency Sensorineural hearing loss the wave V latency is elevated above the threshold of hearing. Retro-cochlear lesions manifest as prolonged Wave V latency and prolonged Inter-wave latency (I to V, I to III, or III to V). But, ABEP waves are normal in low frequency hearing losses.

4.2 Advantages and Disadvantages of BERA [3, 4, 5]

The main advantage of BERA is that it can used to detect hearing ability in newborn, persons in Coma, unconscious persons and Psychiatric patients. It can be used for Medico-

legal cases also, for instance in person claiming deafness for compensation. BERA does not give any frequency specific information. So an additional test called **Auditory Steady State Response ASSR** has been developed. ASSR provides frequency specific information on hearing ability and has all the advantages of BERA. ASSR uses an electrical voltage form called "40Hertz Steady state potential", which can be recorded as a continuous sinusoidal wave from, produced when person is provided sound 10-12dB sound above his hearing threshold. ASSR is recorded just like BERA but gives us more information on hearing defect.

5. Otoacoustic Emissions [3, 7, 8]

Organ of Corti is responsible for conversion of Sound into electrical impulses which are then fed into Brain, creating the sense of hearing. A remarkable property of the Organ of Corti is that it can also produce sound called Oto Acostic Emissions. OAE can be random and spontaneous or they can be in response to a sound, like an echo. Such an echo has been called "Cochlear or Kemp's Echo". Otoacoustic emission is the recording of this sound by a very sensitive microphone. The sound is produced by the Outer hair cells of Organ of Corti.

Presence of OAE indicates that the Organ of Corti is functioning normally. Absence of OAE may be due to noise in background, or simply, that it may be too faint for the microphone to detect or may reflect abnormality of Organ of Corti. Like BERA, patient's cooperation is not needed Portable and battery operated OAE machines are now available. These are now being used to check hearing of newborn children in peripheral and remote places.
There are three types of OAEs' in use [3]

5.1 Spontaneous OAE= this is spontaneous and random recording of OAE. They are recorded in less than 50% normal population, hence not reliable.

5.2. Transient Evoked OAE= TOAE is recorded when the ear is stimulated by a click or Tone burst sound. These are used in screening newborn children. TOAE does not provide any information on hearing threshold and frequency.

5.3. Distortion Product OAE= This method uses geometric mean of OAE Echo produced in response to two separate sounds. DPOAE gives frequency and threshold specific information on hearing ability of the child.

6. Screening for Vestibular Schwannoma

Two complimentary tests are developed recently for screening for Vestibular Schwannoma.

6.1 Fast Spin Echo (FSE) [9, 10]

Fast Spin Echo (FSE) technique is a recent advance in the imaging of vestibular Schwannoma. This uses the interval of time after first echo to receive the echo train. This is done by applying new 180 degree pulses to obtain a spin echo train. Within the lipid molecules, a spin- spin coupling occurs. FSE by rapid pulse disrupts this coupling of molecules and causes T2 weighed image to lengthen. Thus fat appears as higher signal in FSE than in standard echo. Vestibular Schwannoma appear hypo intense compared to CSF on T2-weighted FSE sequences. Intracanalicular tumor appears as a filling defect in the internal auditory canal. This can be rapidly done and does not need a gadolinium contrast. Further Contrast study may be needed only to confirm suspected tumors. FSE is very fast and is less affected by presence of external magnetic fields.

6.2 DIET – Delay Interval Echo Train [9, 10]

DIET sequence is used in FSE sequence to compensate the effect of fat on FSE images. In DIET FSE, Fat appears iso-intense and not bright as in FSE.

6.3 Stacked ABR Technique (Don's Test) [11]

In doing a Standard Auditory Brainstem Response a Wide band Click is used to elicit the amplitude of Electrical activity in the auditory pathway. A wide band click stimulates all the frequency region of cochlea. This signal is extracted by time locking phenomenon of the Electrical activity against electrical noise / interfering signal. "Time locking" phenomenon refer to the Electrical Action potential which occurs at a fixed time interval after the click, while noise can occur at any time. A Standard ABR thus measures only high frequency (fibers) responses of the pathway.

First, a standard BERA is taken and is a part of Stacked ABR/ BERA. Derived banding follows.

6.4 Derived Banding and Stacking [11, 12]

Stacking is the process of frequency wise isolation of neural responses recorded in BERA. Stacking is possible because the Cochlear nerve fibers are arranged in frequency wise bundles. This is called "Tonotopic" arrangement of the fibers of Cochlea nerve. (Greek Tono=sound, Topos= place).

Five different high frequency responses to obtain five Derived-band ABRs that reflect the neural contributions from five different frequency regions of the cochlea. This process is called Derived-band ABR Technique. The Stacking is done by first aligning wave V of the derived-band on time basis, then adding the amplitude of responses. This represents all the frequencies of cochlear. Any reduction in total amplitude is an indicator of pathology in that nerve fiber i.e. Non Conduction in that fiber leading to reduced total amplitude. The Stacked ABR has better sensitivity and specificity than the standard ABR for small size (< 1 cm) tumors. This technique can be used for screening for Vestibular Schwannoma. A Standard ABR / BERA are a part and parcel of Stacked ABR / BERA. So no separate BERA needs be ordered is an added advantage for the patients.

7. CHAMP - Cochlear Hydrops Analysis Masking Procedure (CHAMP) [12]

CHAMP is new investigation, in addition to standard Electrocochleography (ECochG) used to make a diagnosis of

Meniere's disease. A Summating Potential to Compound Action Potential ratio (SP/CAP Ratio) of more than 0.45 is considered diagnostic of Meniere's disease in Electrocochleogram. The result of ECochG is variable especially with the Ear Canal ECochG electrode placement. Trans-tympanic ECochG electrode is more sensitive but is invasive and may be painful. CHAMP overcomes these disadvantages of ECochG.

7.1 Under-masking – Phenomenon [12, 13]

Endolymphatic hydrops or Meniere's disease alters Basilar Membrane properties by stretching it. This stretched Basilar membrane alters the cochlear processing of auditory stimuli.

Low frequency noise can mask the ability to perceive high frequency sound in normal persons. An ABR/ BERA taken after this will show reduced amplitude of waves, especially the wave V.

In Endolymphatic Hydrops / Meniere's disease, this ability is lost and Low frequency noise cannot fully mask the High frequency sound. This is under masking.

A BERA taken in presence of Low frequency sound will still show BERA / ABR waves in Meniere's disease patient. This is in sense Cochlear Hydrops Analysis Masking Procedure or CHAMP.

8. Laser Stamp -Laser Stapedotomy minus Prosthesis [14]

Laser Stamp is a recent addition to procedures for Otosclerosis. It is a conservative procedure where Fissula ante fenestrum is alone involved. This involves doing an Anterior Crurotomy and partial excision of anterior one third of foot plate alone, the logic being that the Otosclerotic process usually only fixes the anterior one third of Foot plate. Hearing improvement with this technique is comparable as with Piston prosthesis. The specific advantage is that if the rest of the foot plate gets fixed, a full stapedectomy can also be done later. There are no the piston related problems like dislocation, perilymph "gusher etc, in addition refixation rates are also low.

9. High Frequency Audiometry [15]

High frequency Audiometry is nothing but Pure Tone Audiometry at Frequency ranges of 8,000 or 8 KHz and more, typically between 10 to 18 KHZ. Audiometry at this frequency is claimed to offer early and accurate detection of Noise induced and Drug induced Hearing losses in Patients.

10. LASER Doppler Vibrometry [16]

LDV is used to find displacement / velocity of a body. It employs two laser beams. The Doppler shift of the one laser beam to other is used to quantify the velocity of a body. It provides accurate measurement of movement of the body, without touching or loading the body. It is used to find a parameter called "Umbo Velocity" of the Tympanic membrane.

Umbo velocity tells us indirectly about the middle ear status just like a tympanometry i.e. ossicular discontinuity, Ossicular fixation, tympanosclerosis, Malleus head fixation etc. In addition, Umbo velocity can be found quickly and in a non invasive manner.

11. VEMP Vestibular Evoked Myogenic Potential [17, 18]

VEMP or Vestibular Evoked Myogenic Potential is a recent test to evaluate the integrity of Saccule. Saccule is sensitive to sound; it was used as a hearing apparatus in some distant evolutionary past. Saccule responds to linear acceleration but on exposure to sound (via Inferior Vestibular nerve) produces a Myogenic Potential is Sternomastoid muscle which can be picked up. So Saccular portion of the labyrinth can now be tested clinically.

11.1 Pathway for VEMP [19]

Sound→ Saccule →Inferior Vestibular nerve →Lateral Vestibular Nucleus →11th Nerve Nucleus→ Vestibulospinal tract →Sternomastoid Muscle→ Inhibition

The response consists of an initial positivity at 13 milliseconds called p13 followed by a more important, negative wave at 23 milliseconds called n23.The most important measure is the amplitude of the waves.

Low amplitude of n23 or higher threshold may be due to conductive hearing loss. Reduced amplitude indicates vestibular disturbances. Prolonged latency of p13 may be due to central causes. Conductive hearing loss obliterates VEMP; Sensorineural Hearing loss does not affect VEMP.

12. Some themes in Cochlear Implant [19, 20]

12.1 Hybrid Cochlear Implant and Hearing aid [19, 20]

Traditionally Cochlear Implantation is reserved for totally deaf patients with severe-to-profound hearing loss. There are a set of patients who have residual hearing especially at Lower frequency which would become redundant if the patient is implanted. For the benefit of such patients "Hybrid Cochlear Implant" has been developed. It is made up of a short "hybrid" electrode which does not extend into and disturb the apical cochlea, and hence preserves hearing at lower frequency. This type of Implant functions only to amplify High frequency sounds and speech.

12.2 Totally Implantable Cochlear Implant [19, 20]

In a traditional Cochlear Implant Sound is detected by an external microphone and directed to an external sound processor. This external speech processor looks like a Hearing aid which may be cosmetically unacceptable for the patient, especially females. To overcome this set back a Totally Implantable Cochlear Implant has been developed which has Speech Processor incorporated.

13. Conclusion

From dusty headphones and claustrophobic acoustic rooms, Audiology has thus advanced to the level where it is today possible to detect a person's hearing acuity; (with BERA and OAE) without even his or her cooperation. Our ability to diagnose Vestibular Schwannoma has also taken a leap with Stacked ABR and FSE MRI. New CHAMP and VEMP are for assessing the Meniere's disease and Saccule function. Hybrid Cochlear implants for partially deaf and Fully Implantable C.I are for the shy person who does not want to wear a visible speech processor.

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Author Profile

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Effectiveness of Vestibular Rehabilitation Therapy in Patients Suffering from B.P.P.V

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Abstract: ***Majority of patients who suffered from Vertigo due to Benign Paroxysmal Positional Vertigo (B.P.P.V) have a residual feeling of imbalance and light headedness. This is compounded by phobia and psychological dread of getting an attack of Vertigo. Most of patients of B.P.P.V need some form of Vestibular Rehabilitation. This study was aimed to examine the benefits of our 21 day customized Vestibular rehabilitation program (Radsan Program). Vestibular Rehabilitation is an effective method of functional restoration of the patient who has been affected with Vertigo.***

Keywords: Benign Paroxysmal Positional Vertigo, Vestibular rehabilitation therapy, Vertigo, Exercise therapy, Posterior Semicircular Canal

1. Introduction

Benign paroxysmal positional Vertigo is by far the most common form of Vertigo encountered in Clinical practice [1]. Most of the patients who suffered from B.P.P.V have constant sense of imbalance and light headedness. This may be due to asymmetric dynamic gain of vestibular reflexes. This study looks at the effectiveness of our Vestibular and Balance rehabilitation strategies used in B.P.P.V patients after the acute phase.

2. Materials and Methods

2.1 Type of study

The degree of suffering from Vertigo and response to Vestibular Rehabilitation is not quantifiable on a percentage or numerical scale; hence this is a type of Non- parametric, before- after response type of clinical study.

2.2 Method of study

Patient selection criterion

A total of 15 B.P.P.V patients were selected. Only those had moved out of acute phase, with Epley and Semont maneuvers or with drugs were chosen [2]. These were the set of patients who needed Vestibular rehabilitation. The entire study was carried out on an out-patient basis, for 3 weeks, in a private practice setup at our Sai Sanjeevan Clinic, Mulund West, Mumbai -80. The study was designed by the principle author and implemented in an integrated manner by his spouse Mrs. Radha in her day today Physical therapy and Rehabilitation practice from Sep 2012 to Jan 2013.

2.3 Diagnostic Inclusion criterion. [1]- [4]

1. Sudden onset of Vertigo associated with movement of head, lasting few seconds to a minute. Frequently the patients report that they get Vertigo immediately after getting up from bed in the morning. Vertigo may be severe (paroxysmal) in nature and may be associated with nausea and vomiting. Patient may feel light headed, weak, tired for many hours following the attack. Vertigo tends to occur in clusters with many months of remission in between attack. Majority of B.P.P.V is due to **Canalithiasis** of the **Posterior Semicircular Canal**, where an up-beating and torsion nystagmus is observed and the torsional component beating towards the earth: **Geotrophic nystagmus.** This is depicted in Figure 1 [2].

In most of the patients there is no identifiable cause. The most common age of presentation is sixth decade, with females affected twice than males [15].

2. A clinically positive Dix-Hallpike maneuver or Nylen-Barany maneuver in the acute phase. This test in done in the following manner, the patient is made to sit on near the edge of examination couch and the head extended to one side, then the head is rapidly brought to below horizontal level of the table in the turned manner. The test is positive if the

   a. Objective component – examiner can spot a Nystagmus and
   b. Subjective component – patient feels Vertigo and nausea. Same test is then repeated with head turned to opposite side [1].

3. Acute phase is arbitrarily defined as one in which the patient experiences acute Vertigo, on and off many times. B.P.P.V progresses from the acute phase which is treated with Vestibular sedatives and calcium channel blockers like Flunarizine and Cinnarizine. Particle repositioning maneuvers like Semont's and Epley's maneuvers were also used in an attempt to reposition the particles and quench the acute phase [3].

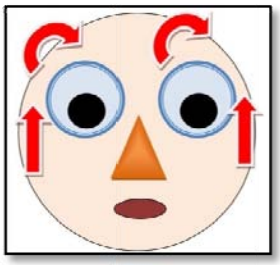

Figure 1: Vertical-torsional Nystagmus in Right Benign paroxysmal positional Vertigo. Fast phase of Vertigo is Upward and Torsional, and the torsional nystagmus beats towards the earth, known as **Geotrophic nystagmus.** Right side is most frequently affected, perhaps because we usually sleep lying sideward, on right side. This causes gradual settling and building up Otoconia to in the low lying Posterior semicircular canal ampulla, over many decades and eventually causing a B.P.P.V [4]

2.4 Exclusion Criterion from Study

Physical therapy is contraindicated, in patients with progressive vestibular pathology. Patients with active vertiginous complaints were excluded. Also patients who had neck instability and frail patients were also excluded from vigorous physical therapeutic demands of Vestibular Rehabilitation [1], [4]. Patients who had any Brainstem or Cerebellar signs or Meningeal signs, unresolving positional Vertigo and atypical nystagmus were also excluded from the study.

2.5 Our Vestibular Rehabilitation program – The Radsan Vhr Program for B.P.P.V [5]

Vestibular rehabilitation was started once the acute phase was over. The patients were given Vestibular Rehabilitation Physical therapy over a period of 21 days. The aims of our Vestibular rehabilitation program are as follows

1. To provide relief to persistent and troublesome symptoms of the B.P.P.V.
2 To restore the confidence level of the patient
3 To allow resumption of his/ her day today activities, and not to be debilitated by the fear of Vertigo.
4. To improve the central vestibular compensation [1].

Medical treatment with vestibular sedatives was reserved only for the control of acute phase symptoms. Patients were kept on minimum medications. Patients were asked to repeat these exercises two to three times a day. Vestibular rehabilitation strategy used in this study included the following components

2.5.1. Desensitization technique and Habituation Exercises [6]
Patients were counseled that the residual imbalance is due to weakness of the vestibular system, overlaid by the fear of the patient. The "Shadow" analogy was used to explain that feeling Imbalance and unsteadiness is like a shadow behind you and that the Vertigo will vanish if one tries to face at it. Patients were also motivated to try these exercises at home. Patients were desensitized to their Vertigo provoking positions and situations like standing with feet close to ground, or walking on a line or standing with on heel and toes. Foam standing, practice where patients were made to stand on foam with eyes closed for 15 – 20 minutes. Early habituation prevents development of motion sickness in long term. [1]. Patients were asked to sleep *only* on the healthy side for 8 hours to allow the otolithic debris to gravitate to the vestibule. This was our modified form of Vannuchi's, 'Forced prolonged position', the original being of 12 hours long duration.

2.5.2 Head-Eye exercises [6],[8]
Adaptation exercises aimed to improve the Vestibulo-Ocular Reflex. Head and eye coordinated movements like following a pen or torch were taught. Patients were asked in their leisure, to follow movement of objects with eye in their home and surrounding. Focusing exercises in which patients try to focus on objects like pen placed between the two eyes. Gaze Stabilization Exercises, in which patient were asked to focus gaze on a moving target like an ant or fly.

2.5.3 Substitution Exercises [8]
Patients were taught to use alternative strategies and sensory information to compensate for the defective Vestibular inputs. Patients were taught to take up a variety of clues from the surrounding and reinforce them into conscious signals for making up the lack of balance. In order to enhance somato-sensory inputs patients were encouraged to move about in bare feet where ever possible. Romberg's position in which the patients practice maintaining standing position with eyes open and then closed, standing on *"terra firma"* and *"terra mollis"*.

2.5.4 Postural, Brandt Daroff and Gait exercise [7]
Patients were asked to practice correct weight-bearing, limiting the range of movement around the center of gravity. Activities included Tandem walking, standing on foam, standing on one leg, and standing with arms outstretched. Brandt Daroff positional exercises were also demonstrated to the patients and patients were motivated to perform them, 15 minutes three times a day. The patient consciously moves the upper and lower half of his body in the same direction, and this is called Ankle Postural strategy. Step strategy in which patient resorts to slow stepping movement used when he senses that he is not stable. Swaying back and forth exercise in which body is alternatively swayed forward and backward.

2.5.5 Maintenance Activities [6]
Most of the patient had a history of sedentary life styles. Patients were asked to engage in a variety of physical activities like running, jogging, using treadmill, bicycling, ball catching, karate, and yoga. This was done as per the patient choice and tolerance levels.

A detailed questionnaire [in English, Marathi and Hindi] was given to the patient asking in Colored gradient Visual analogue scale on the various problems related to the Vertigo [9]. Vestibular rehabilitation strategies were used for 3 weeks. Best results of Vestibular rehabilitation are usually seen after 14 days of therapy [9]. At the end of a Twenty-one day course of therapy, a same second set of questionnaire was given and response to therapy marked. 9 questions were asked and result graded from 0 to 5 on a colored visual cue scale [10]. This questionnaire is given in the table below.

Table 1: Questionnaire with VAS for Vertigo patient
Please choose in the best possible number that describes your suffering at this moment.

S. No	*Question*	*Please tick mark your response on a scale from 0 to 5* *0 = No problem* *1= Mild problem* *2= Moderate* *3= Moderately severe* *4= Severe problem* *5= Totally incapacitated/ over whelmed with problem*
1.	How is your Vertigo?	[0]/[1] / [2]/[3] /[4] /[5]
2.	How is your balance?	[0]/[1] / [2]/[3] /[4] /[5]
3.	How is your dizziness?	[0]/[1] / [2]/[3] /[4] /[5]
4.	How is the feeling of Light headedness?	[0]/[1] / [2]/[3] /[4] /[5]
5.	How are you able to manage day to day activities like office, home work?	[0]/[1] / [2]/[3] /[4] /[5]
6.	Have is the tendency for fall?	[0]/[1] / [2]/[3] /[4] /[5]
7.	How is the nausea?	[0]/[1] / [2]/[3] /[4] /[5]
8.	How is the feeling of blurring of vision with movement (Gaze instability)?	[0]/[1] / [2]/[3] /[4] /[5]
9.	How much you afraid of Vertigo?	[0]/[1] / [2]/[3] /[4] /[5]
	Total score	Minimum score = 0 Maximum score= 45

Figure 2: Colored visual cue scale for Visual analogue scale pertaining to the symptom severity. Green depicts totally symptom free, and at the other end of spectrum is red: the incapacitating or over whelming symptom. [9]

3. Observations

After the completion of Vestibular rehabilitation program, we asked the participants to answer the same questionnaire and the response was tabulated as follows. The outcomes of the study, after 21 days, in relation to each complaint were tabulated. Statistical data analysis of the survey response was done using Computer software GNU-PSPP and PAST (Paleontological Statistics Software for education and data analysis) [11], [12] .GNU PSPP and PAST are free and open source high quality professional statistical tools which allow for a variety of data analysis.

3.1 Statistical Analysis of the Survey [13], [14]

Non parametric statistical tests were employed to calculate the P value and to ascertain the significance of the outcomes of the study. Signed (Binomial) test one tailed (upper) and Mann-Whitney-Wilcoxon Tests were done on computer and significant values computed. The assumed level of significance for all the analysis was 5% (P = 0.05, Z=+1.96). The modified formulae for the questionnaire evaluation are as follows:

3.2 Signed Test [13], [14]

This test uses the following analogy: Probability of getting 15 positive responses from 15 patients for each compliant is computed, it is assumed that there is an equal chance of an improvement and no improvement. This test is not very powerful and can easily give erroneous results.

P (Improvement) = P (No Improvement) = ½ = 50%

Formula 1: Signed [Binomial] non parametric test

$$P\ (k\ sucess\ in\ 15\ trials) = \sum_{k}^{n=15} \binom{n}{k} \left(\frac{1}{2}\right)^{15}$$

3.3 Mann-Whitney Tests [13], [14]

Mann Whitney's test is a gold standard non parametric test. The test results are quite accurate in their prediction. The following formula was derived from the standard Mann Whitney's formula for analysis.

Formula 2: Mann-Whitney non parametric Test

$$U = 345 - R_2$$

R_2 stands for Sum of ranks of items after Vestibular Rehabilitation. The Critical value of U in 15 X 15 situations is 64. To be statistically significant, our obtained U for each problem had to be equal to **or LESS** than this critical value.

Table 2: The statistical inferences drawn out from the survey is given in the table below.

No	*Problems of patient*	*Signed (Binomial) test- one tail P(15) Critical value +1.96*	*Mann-Whitney Tests at 95% Critical Value 64*
1.	Vertigo	Yes	Yes
2.	Balance	Yes	Yes
3.	Dizziness	No	No
4.	Light headedness	No	No
5.	Day to day activities	Yes	No
6.	Tendency for fall	Yes	Yes
7.	Nausea	Yes	No
8.	Blurring of vision	No	No
9.	Vertigo fear	Yes	Yes

4. Discussion

Vertigo is defined as the sensation or illusion of movement without any actual movement taking place.[2] Vertigo word is derived from Latin language *"Verto"* meaning turn or spin. Vertigo arises when there is imbalance in input from

one of the three organs that maintain posture and balance i.e. Muscle spindles, Vestibular system and the Vision-Oculomotor. Cerebellum acts like an on-board computer which integrates these inputs and forwards them to Cerebral Cortex. [4]

Vertigo can have devastating impact on the quality of life of patients. Benign paroxysmal positional Vertigo can quickly leave the patient debilitated and unable to return to normal life. The Vertigo is "Paroxysmal" which means that it can be quite severe enough, leading to vomiting and weakness at its peak. Patients can become afraid to move fearing an attack of Vertigo. This reinforces the psychological distress of positional Vertigo. Most common age of presentation is around 60 years [15]. Majority of patients at this advanced age suffer from some form of Arthritis and have movement and postural problems.

4.1 Canalithiasis vs Cupulolithiasis [17]

Most form of B.P.P.V is due to free debris (Otoconia) floating in the semicircular canals. This phenomenon is called **Canalithiasis** and seems to account for around 95 percent of B.P.P.V. (Figure 2)

Free floating debris in the Cupula/ Crista ampullaris is called **Cupulolithiasis.** This is a rare form of B.P.P.V. (Figure 3)
When the Cupula is horizontal position, patient does not have Vertigo and nystagmus. When the Cupula is not in horizontal position (most of the time), there is a constant stimulation from the inner ear and Vertigo. Thus this is a more problematic entity.

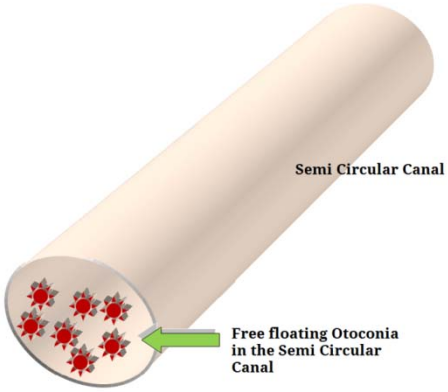

Figure 3: Loose debris (Otoconia) floating in the Posterior Semicircular Canal causes B.P.P.V – Canalithiasis type

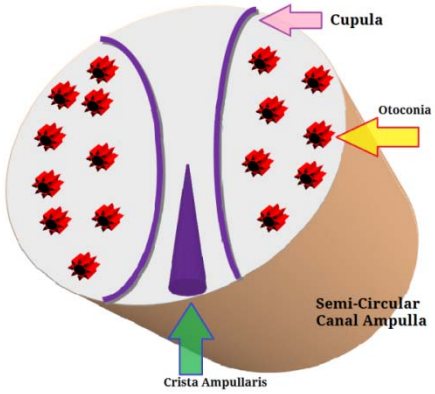

Figure 4: Loose debris (Otoconia) floating in the Cupula of the Semicircular Canal causes B.P.P.V – Cupulolithiasis type

In chronic phase patients of B.P.P.V show deficiency of movement-induced vestibular reflexes and abnormal gain in symmetry and phase of the Vestibulo-ocular reflex (VOR). At molecular level, this seems be related to a reduction in efficacy of Gamma-Amino Butyric Acid (GABA)-A and GABA-B receptors in neurons. Eventually there is an unconscious increase smooth pursuit reflex or generation of saccades or blinks during any head movement to the affected side. This effectively eliminates the visual blur that occurs due to a deficient VOR gain [16].

Table 3: Canalithiasis vs. Cupulolithiasis

Canalithiasis	*Cupulolithiasis*
Latency period present	No Latency period
Paroxysmal attacks of Vertigo	Permanent dizziness
Strong Nystagmus	Weak Nystagmus
Nystagmus undergoes decay	No decay in intensity of Nystagmus
Mostly Geotrophic	Mostly Ageotrophic

4.1 Vestibular compensation [16]

Vestibular compensation is a complex end-result of neural plasticity of the Central Nervous system neurons that compensate for the one sided lack of vestibular input. The different sub systems of the balance, recover from injury at different rates and to different levels. Understanding this difference is a key component of any Vestibular Rehabilitation program. For instance Static ocular/vision reflexes begin to recover within few hours of the injury. Dynamic vestibular – postural reflexes take a much longer time to recover.

In 1940 Terence Cawthorne and Harold Cooksey developed exercises to rehabilitate patients of Vertigo. Their aim was 'to encourage the patient to move his eyes and head freely in all directions'. This concept is applicable even today to Vestibular Rehabilitation.

In Benign paroxysmal positional Vertigo, patients need a gentle introduction to physical therapy. Because most patients have movement fear, early Physiotherapy can help in alleviating the fear-factor and help restore the balance. It is important patients understand the limitations of Vestibular Rehabilitation. **This study aims to highlight where Vestibular rehabilitation can help the patient and where it cannot help**.

From the given table, it is apparent that majority of patients benefit well with Vestibular Rehabilitation. Vertigo is improved very much, the value of Mann Whitney's test was found to be 50. Balance problems are also reduced, with a Mann Whitney's test score of 57. Vestibular Rehabilitation does little to improve the dizziness, light headedness, nausea and gaze instability. Ease of day- today activities is modestly better. Fear of Vertigo also showed a good improvement, the score in Mann Whitney's test was found to be 55.

5. Conclusion

Vestibular rehabilitation is a powerful method for functional restoration of the patient who has been affected with Vertigo, especially Benign Positional Paroxysmal Vertigo. The program of Vestibular Rehabilitation [Radsan protocol] developed by us, seems very effective in alleviating the symptoms of Vertigo and improves the balance. It promotes an early resumption of day today activities and reduces Vertigo-phobia. Late development of Motion sickness is also prevented

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Authors' Profile

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Clinical profiles in Patients Suffering from Chronic Tension-type Headache

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Abstract: ***Chronic Tension-type headache is the most common type of headache encountered in clinical setup. This study aims to examine the clinical profile of patients suffering from chronic Tension-type headache.***

Keywords: Tension-type headache, Chronic headache, Episodic headache, Daily headache

1. Introduction

Tension type headache is the most common type of headache seen in E.N.T headache clinic. This condition is particularly common in multiparous females, has been dubbed the "House-wife's headache". The persistent day-today nature of this headache has bestowed, the name "Daily headache" to this condition [1]. This study aims to study the clinical profile of patients suffering from the chronic variant of Tension-type headache, which is arbitrarily defined as Tension-type headache for more than 180 days in a year

2. Materials and Method

Patients were chosen from the subset of cases who attend our E.N.T headache clinic. We have a specialized O.P.D for diagnosis and management of Headache held on Tuesdays and Thursdays. Due consent was obtained from all cases and hospital and departmental ethical committee approval was obtained before the initiation of the study.

3. Diagnostic Inclusion Criteria

A total of 50 patients were chosen from the Headache clinic for this study. The diagnostic criteria for Chronic Tension type headache used in this study was as follows.

3.1. At least 10 episodes per year, Headaches lasting more than 180 days in a year [2] or than 15 days a month(Ref 1 and 6).

3.2. Bilateral headache, pain compressive in nature mild to moderate intensity localized to forehead. Pain intensity varies from attack to attack, with each attack lasting from minutes to hours.

3.3. Neck pain and rigidity of neck muscles [1, 6]

3. 4. A "Band" like constricting type of frontal pain was considered diagnostic [4]. Typically, the pain increases as the day progresses [5]. Presence of Depressive symptoms and any history of Psychiatric problems are a part of Tension type headache, hence were not excluded (Ref 4). Emotional stress was enquired as it is a known trigger for Tension type headache. Day today work and exertion does not increase the intensity of Chronic Tension-type headache [7].

3.5. General, E.N.T and neurologic examination is normal [2]. Blood pressure was checked to ensure normalcy, as Hypertension can by itself lead to Headache. Ophthalmological evaluation of Fundus and Visual fields was done to rule out Papilloedema and Brain tumors.

3.6. Pericranial Tenderness [6]

This is one of the clinical diagnostic test for Tension type headache. Palpation for the Pericranial Tenderness involves using two fingers to palpate the Frontalis, Temporalis, Masseter, Pterygoid, Sternomastiod and Trapezius muscles. This is included in second revision of International Classification of Headache disorders [6].

4. Diagnostic Exclusion criteria

4.1. Unilateral headache are suggestive of Migraine and related disorders were excluded [1]

4.2. Nausea, vomiting, photophobia, Aura are suggestive of Migraine were excluded [2].

4.3. Medication rebound headache is a distinct entity, with a picture similar to chronic tension type-headache. Subjects with a history of self administration of drugs, and use of over the counter pain killers for more than 3 months were not included in this study [8]

5. Type of Study

This was a type of Cross sectional descriptive epidemiological clinical study.

5.1 Methodology of study

The subjects who attended our Headache clinic were enquired about their willingness to participate in our study. After obtaining their consent they were given a questionnaire based on International Classification of Headache Disorders—2nd edition criteria (Ref 6). Their response to various test items, classified and tabulated and presented in the results as follows.

6. Observations

6.1 Sex wise distribution

Majority of Chronic Tension-type headache headaches are females (33/50) and Male to female ratio in our study was found to be 2:1 (= 33/17). This means that Tension-type headache is twice as more common in females than in males.

6.2 Average age of onset

Based on the questionnaire, Age of onset of headache was determined for the 50 patients and is summarized in the following graph.

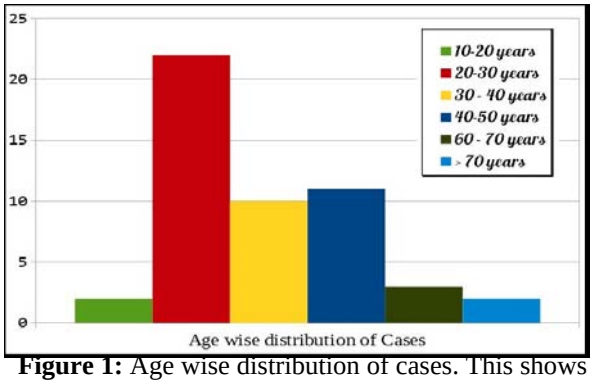

Figure 1: Age wise distribution of cases. This shows that most common age of onset is 20to 30 years. Chronic tension type headache is rare in extremes of age.

As it can be inferred from above, that the most common age of onset of Chronic Tension-type headache is early adulthood (20 -30 years) and Middle ages (30 to 50 years). Onset of this condition seems to be rare in extremes of ages.

6.3 Number of years of suffering

Chronic tension-type headache is a long standing condition that last for years and even decades. The following graph was drawn after feeding the data into the PAST statistical software package, it depicts the number of years of suffering.

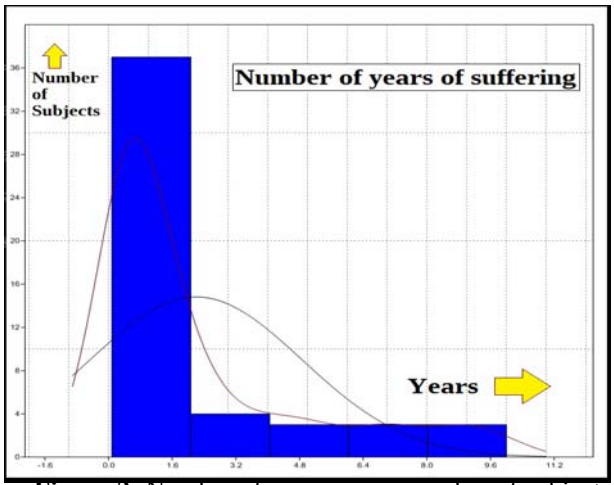

Figure 2: Number of years versus number of subjects. Chronic Tension type headache patients suffer from headache lasting an average of 2.2 years in duration. Overlaid on the background is the Normal curve.

The mean number of years of suffering was found to be 2.2 years (2 years 2 months 12 days). The standard deviation was found to be 2.7, standard error was found to be 0.38.

6.4 Quantification of Pain

A Visual Analogue scale (VAS) was used to quantify the intensity of pain from 0 to 10. The patients were asked to quantify the intensity of pain experienced during most of the episodes. The score of 0 represented no pain and 10 the worst pain they could imagine. This 0 to 10 VAS modelled after the pattern in similar studies on chronic headache. The patient reporting of pain is depicted below.

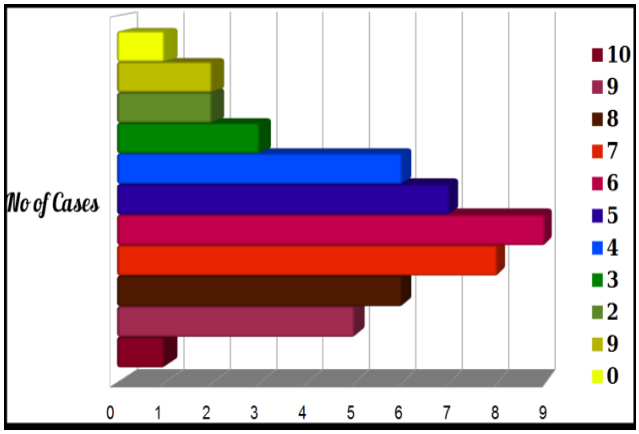

Figure 3: The intensity of pain on a visual Analogue scale as perceived by the patients. Majority of the patient reported the intensity on scale 6/10 as seen from graph. This classical picture of any Chronic pain.

6.5 Pericranial tenderness

Almost all the patients who participated in this study gave positive reponse to pericranial tenderness test (47 positive /50 cases = 94% of cases). This is a very important diagnostic clinical sign of Chronic tension type headache.

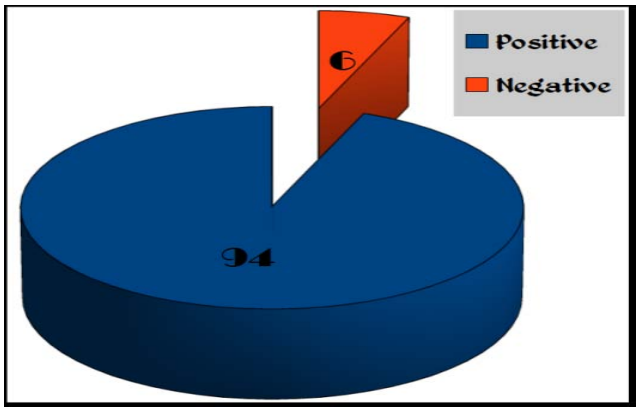

Figure 4: Pericranial tenderness was found in 94% (47/50) of the cases.

7. Discussion

The chronic subtype is of a more problematic entity, which is the cause of severe disability in sufferers and also leads to social stress. Pericranial tenderness is listed as a diagnostic finding in The International Classification of Headache Disorders, 2nd edition. Central pain perception mechanism

seems to play a pivotal role in chronic tension-type headache (Ref 6 and 11).

A "Band" like constricting type of pain, with a feeling of heaviness is again a hall mark feature of this condition. The following figure illustrates this.

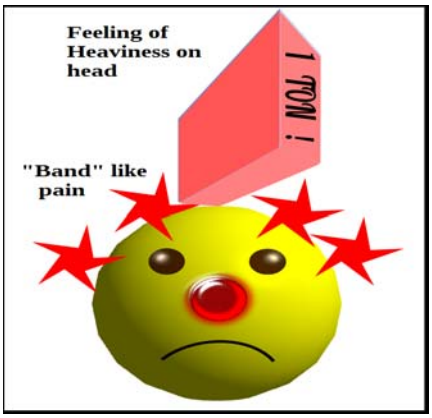

Figure 5: The hallmark, "Band" like bilateral pain over the scalp along with a feeling of heaviness over the head of Tension type headache. This is accompanied by the Pericranial muscle tenderness on palpation.

Most of the patients had the onset of the headache in their 20s and 30s, which was persistent; the average duration of suffering for a patient was 2.2 years. This was elucidated from our study. Day today work and exertion does not increase the intensity of Chronic Tension-type headache [7]. Majority of the patient reported the intensity on scale 6/10 as seen from above graph. In addition, varying intensity of pain is a classical symptom of tension- type headache, and pain is never severe in Intensity. This is the intensity represented by the grades 4,5,6,7 in the VAS scale used in our study and is illustrated in the cartoon picture that follows.

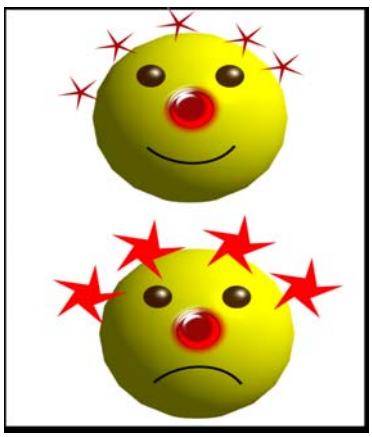

Figure 6: Varying intensity of pain "band" in Tension type headache, with mild pain patient can carry out his day today activities (Shown by smiling face). Days when he has severe pain can be incapacitating (Shown by sad face). Patients can go on for months with suffering.

Chronic migraine in which the sufferer has pain for more than 15 days in month is a differential diagnosis of this condition. But migrainous headache is more severe, unilateral and associated with nausea and photophobia. Medication-overuse headache is also a differential diagnosis of this condition.

Medication-overuse headache, (also known as Medication rebound headache) could develop after Regular overuse of drugs for more than 3 months. Subjects with history of self administration of drugs, and use of over the counter pain killers for more than 3 months were thus excluded from the study [8].

There seems to be altered pain perception in chronic tension-type headache patients. This change of perception seems to influence the conversion of frequent to chronic variant of Tension-type headache [10]. Certain authors like Jones classify bilateral mid-facial segmental pain (MFP) as a component of Primary headache specially the Tension-type headache pain. Tension type headache leads pain in the frontal, parietal, temporal in distribution [12].

The current model of Tension type headache attributes a Neurotransmitter probably Nitric oxide excess in second order neuron at the trigeminal nucleus sub-caudalis, leading to Hypersensitivity and release [13]. Nitric oxide inhibitors seem to be efficacious in treatment of Chronic Tension type headaches. Skin over the forehead and Temporal is particularly rich in Trigeminal nerve, which also supplies most of the scalp including the Occipital region. This explains the pain distribution in Tension type headache [14].

Pericranial tenderness is tenderness of pericranial myofascial tissues, soft tissue and muscle attachements that surround the skull: the Frontalis, Temporalis, Masseter, Pterygoid, Sternomastioid and Trapezius muscles. This can be done by hand palpation or by an algometer and graded on a 4 point scale [16]. Pericranial tenderness is a very sensitive sign in the diagnosis of Chronic tension type headache, present in 94% of the cases in our study. This may be the most important clinical sign of Chronic tension type headache [15].

Sinusitis can lead to dull aching pain lasting few hours in a day, but this is accompanied by Nasal discharge and nose block, sometimes with fever and fatigue [15, 16]. Pericranial soft tissue tenderness can be easily confused with Paranasal sinus tenderness which is elicited on the Sinus walls. Tenderness of muscles is a differentiating point for Tension type headache.

8. Conclusions

8.1. We conclude, Chronic tension type headache is a clinical condition with onset around youth (25 years of age 20-30), and a chronic variable course lasting many years. The average duration of suffering being 2.2 years. (2.2+/- 0.76).

8.2. Majority of patients suffer from a bearable type of variable moderate intensity pain (6 on VAS) lasting few hours on most of the days.

8.3. Pericranial tenderness is a important, underutilized diagnostic sign of Chronic tension type headache. This must not be confused with Paranasal sinus tenderness which is a entirely different condition altogether.

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