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Original article

To estimate the point prevalence of Rifampicin resistant tuberculosis in extra pulmonary tuberculosis patients' as detected by CBNAAT in a district hospital and to analyze the data using logistic regression mathematical model

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Abstract

The aim of this study was to estimate the point prevalence of Rifampicin resistant Mycobacteria causing tuberculosis of lymph node as detected by cartridge based nucleic acid amplification test (CBNAAT) and analyzed using logistic regression mathematical modeling. An observational cross-sectional study was carried out in the Department of Otorhinolaryngology from July 2019 to February 2020 in a tertiary healthcare setting. Rifampicin resistant Mycobacteria were identified; data tabulated and analyzed to find the point prevalence of Rifampicin resistant tuberculosis. A total of 37 patients who presented to the OPD were included in the study. Confirmation of the tuberculosis was done either by fine needle aspiration cytology (FNAC) or by direct biopsy. Demographic characteristics of the patients were analyzed. A logical regression mathematical model of Rifampicin resistance in the district was created. Correlation matrix was calculated using Jamovi software. Occurrence of Rifampicin resistance was dependent variable in logistic regression modeling. Levels VA and VB, posterior triangle group lymph nodes were most commonly involved. It was found that there is high prevalence 89.189% ($p<0.01$) of Rifampicin resistant Mycobacteria. Rifampicin resistance have a 2.9672 greater odds per stage (196% higher chance $p=0.0291$) treatment failure as compared to Rifampicin sensitive patients. Females have higher risk of harbouring Rifampicin Resistant Mycobacteria than males.

Key words: Cervical lymph node tuberculosis, Multi-drug resistant tuberculosis, Nucleic acid amplification test, Rifampicin

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Tuberculosis (TB) can affect any organ in the human body with the exception of hair and nails[1]. India is experiencing increasing cases of TB due to diabetes mellitus and human immunodeficiency virus (HIV). Extra pulmonary TB makes up 15–20% of TB cases in India[2]. Extra pulmonary TB occurs more commonly in immune-suppressed patients due to hematogenous spread

of the bacilli[3]. In India tuberculous lymphadenitis is one of the most common presentations of extra pulmonary TB (incidence 34.4% of cases)[4]. In almost 30% (1/3 incidence) of these patients have concurrent pulmonary tuberculosis for which they must be actively screened. The most common infected site is the cervical group of lymph nodes especially the posterior triangle nodes; this is followed by axillary lymph nodes[5]. For some unknown reasons in India the disease is extremely more common in females than males. After confluence of the nodes called the "matting" the nodes break out of the investing layer of deep cervical facia to from a tubercular sinus. The typical TB sinus is described as having "thin, bluish, undermined edges with scanty watery discharge"[6].

It has been observed that there is raising incidence of Rifampicin resistant tuberculosis and muti-drug resistant tuberculosis in India[7]. The connection between drug resistant Mycobacterium causing extra pulmonary lymphadenitis in India is not explored. This research addresses the evolution of drug resistant tuberculosis as a causative agent of extra pulmonary lymph node tuberculosis.

The purpose of this study was to estimate the point prevalence of Rifampicin resistant tuberculosis in extra pulmonary tuberculosis in lymph nodes as detected by cartridge based nucleic amplification test (CBNAAT) in district hospital and to describe the clinical features of cervical TB lymphadenitis who present in ENT OPD. Also, to mathematically model the Rifampicin resistance, Jones and Campbell stage, lymph node size, height, weight, BMI and age using logistic regression (Binomial or Bernoulli distribution and the logit link) and to compute parameters like odds ratio, likelihood ratio, "Z" value, etc. at 95% confidence intervals and draw up inference.

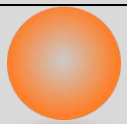
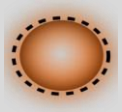
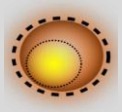
Materials and methods

An observational cross-sectional study was carried out in the Department of Otorhinolaryngology of a major district hospital from July 2019 to February 2020 in a tertiary healthcare setting. A total of 37 (N=37) adult cases were included in this study. Inclusion criteria of cases were adult patients who had clinical features of extra pulmonary tuberculosis cervical lymph node disease. Ultrasound-guided targeted fine needle aspiration cytology (FNAC) or a lymph node excision biopsy for final confirmatory diagnosis of tuberculosis. Aspirated or biopsied material was sent for by cartridge based nucleic amplification test (CBNAAT) in TB clinic of the district hospital. Rifampicin resistant Mycobacteria were identified and data tabulated, analyzed to find the point prevalence of Rifampicin resistant tuberculosis. Consent was obtained from the patients before inclusion in the study.

Clinical history was obtained in all cases which were typical of tuberculosis i.e. loss of weight and appetite, evening raise of temperature, night sweats, cough lasting more than 4 weeks, chest pain, expectoration if it was blood stained, breathlessness, neck swellings and pain in the swelling. A history for pulmonary tuberculosis was included as up to 1/3 of extra pulmonary tuberculosis patients suffer synchronously from a pulmonary tuberculosis focus[2].

Jones and Campbell in 1962 described a classification system for stages of cervical lymph node tuberculosis[8]. This system was used extensively in this study (Table1). The pictures were modeled by the author in Inkscape Vector graphics software package. 3-Dimensional Scalable Vector Graphics (SVG) outputs of the models of lymph nodes can be had from the author.

Table 1: Jones and Campbell classification (1962) of stage of cervical lymph node tuberculosis (drawn by author)[8]

Stage	Physical characteristic of lymph node	Picture
1	Enlarged, firm, mobile, discrete nodes showing non-specific hyperplasia	
2	Large rubbery nodes fixed to surround tissue owing to periadenitis	
3	Central softening due to abscess formation	
4	Collar-stud abscess formation	
5	Sinus tract formation	

Complete blood count (rule out leukemia, anemia), ESR, random blood sugar (to detect type 2 diabetes mellitus) and HIV ELISA Card test (for AIDS, immune suppression) were done. Mantoux test was done in children only in this study; it was performed in those who did not have BCG scar on the upper arm to detect previous exposure to Mycobacterium. Chest X ray was done in all patients.

Sputum for acid fast bacilli (AFB) was done using Ziehl-Neelsen (ZN) stain for only those who had history of cough along with productive sputum.

Ultrasonography (USG) was done in all cases, as it is a non invasive investigation. Anechoic or hypoechoic areas lymph node was the most common radiology picture. These are due to central necrosis and liquefaction to cold abscess. Ultrasound-guided targeted FNAC or a lymph node excision biopsy was used for final confirmation of tuberculosis. Occasionally calcifications inside a lymph node or fully calcified nodes were noted. Fibrosis and fixity to deep cervical facia was also findings in few cases.

Fig 1. Figure shows sinus formation of the right posterior auricular lymph node with massive cold abscess formation in the jugulo-diagastric lymph node behind the angle of the right mandible. CBNAAT of the aspirate yielded Rifampicin resistant mycobacteria.

FNAC was performed using 10ml disposable syringe with 22-gauge needle. Multiple passes were made into the Lymph node while maintaining steady suction. The slides were then alcohol fixed and stained using Papanicolaou stain. In case there were multiple nodes involved which were the majority of cases, FNAC was done from the most fluctuant node. This was done because around 5ml of purulent material to perform CBNAAT which must not contain blood. Care was taken to perform an aseptic aspiration and non dependent manner to avoid secondary infection and sinus formation. In few cases FNAC was inconclusive and these were commenced on a 10 days course of antibiotics. Standard guideline drug therapy of Penicillin or Amoxicillin twice or thrice a day was administered for 10 days (Clindamycin or Co-trimoxazole were other approved choices)[9]. Both these antibiotics are not effective against tuberculosis and would not interfere with the outcome. Persistent antibiotic unresponsive neck lymphadenopathy was treated by excision biopsy (for small node) or an incision biopsy (for a large, matted node). All the diagnosed cases of TB in this research were notified, given a TB card and DOTS for TB was started in accordance with the Revised National Tuberculosis Control Program (RNTCP) for India[10].

Statistical analysis

Categorical variables were compared using the chi-square test or the Mantel-Haenzsel chi-square test for trend. Sampling strategy used was population based simple random sampling. This whole study used Jamovi software package which is a graphical front end for R programming language to do biostatistical analysis[11,12]. Statistically significant association was taken to be $p < 0.05$ at 95% confidence interval for this whole research. Correlation matrix was calculated. Occurrence of Rifampicin resistance is dependent variable used for logistic regression modeling. Logistic regression modeling which uses binomial (Bernoulli) distribution (only 2 outcomes yes or no) was used to analyze and create a mathematical model the Rifampicin resistance data. The mathematical model was charted and odds ratios and 95% ($p=0.05$) confidence intervals were computed. Logistic regression assumes that the observations are independent of each other and one observation does not interfere with another. Schema of coding the exposure variable was as follows: Rifampicin resistance was taken as 1 (hit) and sensitive as 0 (miss), and the odds ratio, Model fit measures, Omnibus likelihood ratio test, Chi square test were analyzed at 95% ($p<0.05$) confidence interval. Computer generated model coefficients for Rifampicin resistance was calculated and odds ratio inferred.

Results

Demographic, clinical, social information of the study participants are presented in table 2.

Table 2: Demographic characteristics of study population

Characteristic		Median	p value
Age (Adults >14 years of age) in years		26	<0.001
Sex	Male	13	<0.001
	Female	24	
Education level	High school or less	32	0.09
	Higher education	7	
Employment	Employed	27	0.03
	Unemployed	10	
Other diseases	Type 2 diabetes mellitus	6	0.421
	HIV positive	12	0.032
	Malnutrition	12	0.127
Below poverty line		34	0.00216
Place	Palanpur city urban	16	0.017
	Surrounding villages	21	0.033
Size of lymph node (cm) Assumed 1 cm and less nodes not palpable clinically, USG neck was done in all cases		2.7	0.002
Height (cm)		163	0.389
Weight (kg)		55	0.717
Body mass index (BMI) (kg/m^2)		21.5	0.087
Rifampicin resistance		33/37= 89.189%	<0.01

Table 3: Pattern of involvement of neck lymph nodes by tuberculosis

Type of lymph nodes	Cases	Mean size of lymph node (cm)	p value
Levels VA and VB: posterior triangle group	20 (54%)	3.2	<0.01
Levels IA and IB: submental and submandibular groups	3 (8%)	1.5	0.562
Levels IIA and IIB: upper jugular group	16 (43.24%)	2.5	0.050
Level III: middle jugular group	13 (35.13%)	1.9	0.278
Level IV: lower jugular group	8 (21.62%)	2.1	0.01
Level VI: anterior (central) compartment group	0 (0%)	-	-

Location and type of nodes

The most common causes of acute cervical lymphadenopathy are viral upper respiratory infections, acute pyogenic bacterial infections by Streptococcus pyogenes (group A Beta hemolytic streptococcus) and Staphylococcus aureus. These nodes are mostly tender. Subacute or chronic cervical lymphadenopathy is caused by tuberculosis, non-tuberculous mycobacteria (NTM), actinomycosis and nocardiosis. Nocardia infected lymphnodes are unusual, that they are tender.

Lymph nodes affected by Mycobacteria were classified in accordance with American Academy of Otolaryngology[13]. Levels VA and VB, posterior triangle group were most commonly involved. VA and VB are separated by an imaginary horizontal plane from inferior border of the arch of the cricoid cartilage. Paradoxical lymph node enlargement and new lymph node involvement, sinus formation in middle of tuberculosis drug therapy was observed in 37.84% cases. This was managed by local therapy Magnesium sulphate pack application and reassurances that these will disappear once course of drugs is completed. The observed pattern of involvement of cervical lymph nodes is depicted in the table 3.

Correlations between various study variables were done using Spearman's rank correlation metric as data was non-parametric. There was strong positive correlation between Jones and Campbell stage and size of lymph node Spearman's rank correlation was 0.434 ($p<0.01$) highly significant. This was logically expected as bigger nodes were likely to be at a higher stage of disease. This also validates the Jones and Campbell (1962) classification of stage of cervical lymph node tuberculosis as a valid clinical tool in staging lymph node spread of disease. Body mass index was strongly (spuriously) correlated with weight and negatively correlated with height, which is understandable as it is a dependent variable of the two (Spearman's rank=0.761 $p<0.001$). Body mass index was negatively correlated with Rifampicin resistant tuberculosis but was not statistically significant (Spearman's rank =-0.110, $p=0.742$).

Mathematical modeling using logistic regression analysis

Logistic regression analysis done found that Rifampicin resistance is significantly associated with body mass index (Chi square value 5.852, df=1, $p=0.016$), height (Chi square value 6.001, df=1, $p=0.014$), and weight (Chi square value 5.769, df=1, $p=0.016$).

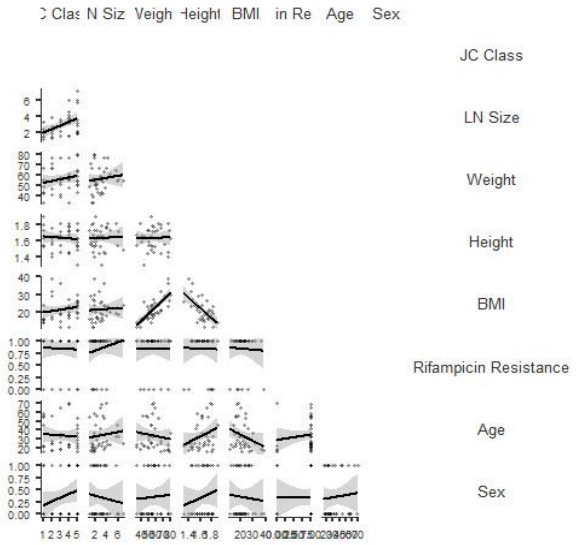


Fig 2. Figure shows the correlation between Jones and Campbell Class, lymph node size, weight, height, BMI, age sex and Rifampicin resistance using Spearman's rank correlation

Mathematical model generated coefficients for Rifampicin resistance, odds ratio for height was 4.09X 10^{-17} (p=0.036) here Log_e odds was -16.3883. There is a negative connection between height and Rifampicin resistance. Likewise BMI odds ratio was 0.284 (p=0.037) meaning 71% higher risk of occurrence of Rifampicin resistance with decreasing BMI. While for weight odds ratio was 1.650 (p=0.040) which means higher 65% risk of Rifampicin resistance in higher weight patients.

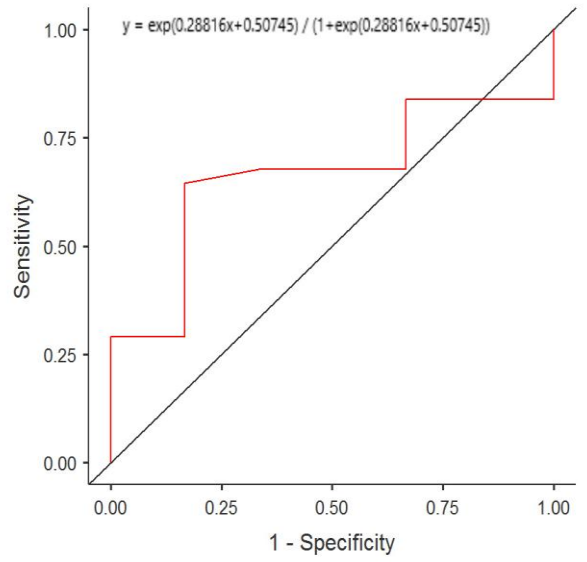


Fig 3. Mathematical Logistic regression modeling of the obtained data

There was no significant contribution to development of Rifampicin resistance by Jones and Campbell stage, size of lymph node, age and sex of the patient. Individuals with CBNAAT detected Rifampicin resistance have a 2.9672 greater odds per stage (196% higher chance p=0.0291) treatment failure as compared to individuals with sensitive patients.

Discussion

The most common site of extra pulmonary tuberculosis in India is lymph nodes (as well in many other parts of the developing world. GeneXpert MTB is a new molecular diagnostic test for TB, in addition to being highly sensitive for diagnosis of tuberculosis and Rifampicin drug resistance. This is particularly true in high-burden areas like North Gujarat. Drug susceptibility testing (DST) by cultures growing Mycobacterium often takes 8–10 weeks for a result which is simply too long for practical use. Line probe assay (LPA) which detects Isoniazid (INH) and Rifampicin (Ri) resistance is not available widespread in India hence most practical and quick method of diagnosing of tuberculosis and drug resistance is by GeneXpert MTB CBNAAT. Results are expeditiously obtained in about 2 hours which saves time of the health worker and also the patient from defaulting. The test is completely automated so the chances of contamination and laboratory error are minimal. Sensitivity was 95% which means the test accurately identifies 95 tuberculosis patients out of 100 patients and specificity was 98% which means the test results are negative for 98 normal patients out of 100 normal patients. These values re-establish the protagonist role of GeneXpert MTB CBNAAT in diagnosis of drug resistant tuberculosis.

Females have higher risk of harboring Rifampicin resistant Mycobacteria than males (p<0.48). Firstly, this may have to do with the fact that in Indian population the incidence of malnutrition is more in female children than males. Secondly, due to nature of lympho-hematogenous reaction in TB lymph node involvement is more common in females.

In this research Rifampicin resistance was found to be 89.189% (p<0.01) this is disproportionately high prevalence of resistant mycobacteria. This phenomenon of resistance was connected with body mass index, lower the BMI higher the chance of harboring resistant Mycobacteria.

Limitations of the study

Limitations of this study were that it was done in a district hospital setting and limited role of private practitioners' were ignored. Sample size was adequate at 37 though not very large; this was due to inclusion of only lymph node tuberculosis cases.

Interferon-gamma release assays (IGRA) has high diagnostic accuracy in TB lymphadenitis in areas of higher prevalence. This investigation was not studied and any benefit of this new test is yet to be seen. Another emerging investigation is positron emission tomography (PET) scan which according to some papers is useful for studying response to anti-tuberculosis therapy and differentiation of patterns of pulmonary tuberculosis. The high cost (around the time of publication 25,000 rupees) and radiation exposure precludes routine use of this tool in tuberculosis imaging.

Conclusion

There is high prevalence 89.189% of Rifampicin resistant tuberculosis in our district. This study is a wakeup call to the stake holders and policy makers to the increasing cases of multidrug resistant (MDR) tuberculosis in India. Females have higher risk of harboring Rifampicin resistant Mycobacteria than males ($p<0.48$). Rifampicin resistance is negatively correlated with height and body mass index. Malnourished and stunted patients have statistically significant higher risk of harboring Rifampicin resistant tuberculosis Mycobacteria ($p=0.037$) as per our mathematical model. Rifampicin resistance have a 2.9672 greater odds per stage (196% higher chance $p=0.0291$) treatment failure as compared to individuals with sensitive patients. Erythrocyte sedimentation rate (ESR) is elevated in most cases but is not specific for tuberculosis. The Jones and Campbell (1962) classification of stage of cervical lymph node tuberculosis is validated as a valuable clinical tool in the staging of lymph node spread of Mycobacteria. Paradoxical lymph node enlargement and new lymph node involvement, sinus formation in middle of tuberculosis drug therapy was observed in 37.84% cases. These can be conservatively managed.

Ethical consideration: Clearance was given by the Ethics Committee of Banas Medical College and Research Institute, Palanpur Civil Hospital.

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Conflict of interest: None

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References

1. Nair SA, Raizada N, Sachdeva KS, Denkinger C, Schumacher S, et al. Factors associated with tuberculosis and rifampicin-resistant tuberculosis amongst symptomatic patients in India: A retrospective analysis. PLoS One. 2016; 11(2).
2. Cherian JJ, Lobo I, Sukhlecha A, Chawan U, Kshirsagar NA, Nair BL, Sawardekar L. Treatment outcome of extra pulmonary tuberculosis under Revised National Tuberculosis Control Programme. Indian Journal of Tuberculosis. 2017; 64(2):104–8. DOI: 10.1016/j.ijtb.2016.11.028
3. Naing C. Meta-analysis: the association between HIV infection and extra pulmonary tuberculosis. Lung. 2013; 191(1):27–34.
4. Lee HY, Lee J, Lee YS, Kim MY, Lee HK, Lee YM, Shin JH, Ko Y. Drug-resistance pattern of Mycobacterium tuberculosis strains from patients with pulmonary and extrapulmonary tuberculosis during 2006 to 2013 in a Korean tertiary medical center. Korean J Intern Med. 2015; 30(3):325–34. DOI: 10.3904/kjim.2015.30.3.325
5. Geldmacher H. Assessment of lymph node tuberculosis in northern Germany: a clinical review. Chest. 2002; 121(4):1177-82.
6. Lee JY. Diagnosis and treatment of extra pulmonary tuberculosis. Tuberculosis Respiratory Diseases. 2015; 78:47–55.
7. Menon S, Dharmshale S, Chande C, Gohil A, Lilani S, Mohammad S, et al. Drug resistance profiles of Mycobacterium tuberculosis isolates to first line anti-tuberculous drugs: A five years study. Lung India. 2012; 29(3):227-31.
8. Jones PG, Campbell PE. Tuberculous lymphadenitis in childhood: the significance of anonymous mycobacteria. British Journal of Surgery. 1962; 50:302-14.
9. Fine AM, Nizet V, Mandl KD. Large-scale validation of the Centor and McIsaac scores to predict group A streptococcal pharyngitis. Arch Intern Med. 2012; 172(11):847–52.
10. Chauhan LS, Agarwal SP, editors. Tuberculosis control in India. New Delhi: Directorate General of Health Services Ministry of Health and Family Welfare; 2005. The revised national tuberculosis control programme (RNTCP) pp.23–34.
11. The Jamovi project. jamovi (Version 1.1) Computer Software. 2019. Available from https://www.jamovi.org
12. R Core Team. R: A language and environment for statistical computing. Computer software. 2018. Available from https://cran.r-project.org
13. Deschler DG, Moore MG, Smith RV, eds. Quick reference guide to TNM staging of head and neck cancer and neck dissection classification, 4th ed. Alexandria, VA: American Academy of Otolaryngology–Head and Neck Surgery Foundation, 2014.

INDEX COPERNICUS INTERNATIONAL

ARTYKUŁ ORYGINALNY / ORIGINAL RESEARCH ARTICLE

New rapid diagnostic criteria of Acute Sinusitis based on patterns of headache and facial pain in Sinusitis: A study of 117 patients suffering from sinusitis

Nowe i szybkie kryteria diagnostyczne ostrego zapalenia zatok przynosowych oparte na wzorach bólów głowy i bólu twarzy w zapaleniu zatok. Badanie 117 pacjentów cierpiących na zapalenie zatok

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ABSTRACT:

Introduction. There is need for any healthcare setup to rapidly identify Sinus headache patients from other cases of Neurological and Primary headaches like Migraine and Chronic Tension type headache.

Materials and Methods. 117 cases of confirmed sinusitis were evaluated and analysed for common traits which could help in rapid diagnosis of Sinusitis.

Results. Unilateral, dull aching headache and facial pain, of changing intensity, lasting all day on an average of 4 to 6 hours with a previous short history of common cold in acute sinusitis is the most common pattern observed in this study.

Discussion. Unilateral, dull aching headache and facial pain, of variable intensity, lasting all day on an average of 4 to 6 hours along with is highly sensitive criterion (91%) for diagnosis of acute sinusitis. This, along with a history of previous Upper Respiratory tract infection, is useful to rapidly screen patients for acute sinusitis (95% sensitive). Though a subset of other headache cases will also be included by the criteria, imaging or Endoscopy must be done in these positive cases to increase the specificity of the diagnostic criteria.

KEYWORDS: rhinology, Sinus, headache, chronic sinusitis, acute sinusitis, Diagnostic criteria

STRESZCZENIE:

Wprowadzenie. Istnieje potrzeba, aby dowolna konfiguracja opieki zdrowotnej była w stanie dokonać szybkiej identyfikacji pacjentów z zatokowym bólem głowy w innych przypadkach bólów głowy (neurologicznych i pierwotnych), takich jak migreny i przewlekły ból głowy.

Materiały i metody. Dokonano oceny 117 przypadków potwierdzonych przypadków zapalenia zatok przynosowych, które wykazały cechy wspólne, mogące pomóc w przyśpieszeniu diagnozy zapalenia zatok.

Wyniki. Najczęstszym wzorem obserwowanym w badaniu jest jednostronny, głuchy ból głowy i ból twarzy, zmiana intensywności, trwająca codziennie przez średnio 4-6 godzin, z krótką historią przeziębienia w ostrym zapaleniu zatok.

Dyskusja. Jednostronne, głuche bóle głowy i bóle twarzy, o zmiennej intensywności, trwające codziennie przez średnio 4-6 godzin, wraz z wysoce wrażliwym kryterium (91%) w diagnostyce ostrego zapalenia zatok. Wspomniane in-

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formacje, wraz z historią poprzedniego zakażenia górnych dróg oddechowych są użyteczne dla szybkiej diagnozy pacjentów z ostrym zapaleniem zatok (wrażliwość 95%). Jednakże, w przypadkach tych dochodzi do występowania podzbioru innych przykładów bólu głowy, dlatego też we wspomnianych pozytywnych przypadkach należy przeprowadzić badanie obrazowe lub endoskopię w celu zwiększenia specyficzności kryteriów diagnostycznych.

SŁOWA KLUCZOWE: rynologia, zatoki, bóle głowy, przewlekłe zapalenie zatok, ostre zapalenie zatok, kryteria diagnostyczne

INTRODUCTION

Annually half of the general population (50%) suffers from a headache and 9 out of 10 people from the general public give a history of at least one episode of headache in their whole life [7]. A vast number of patients who present to general clinic for recurrent headache do not suffer from Sinusitis [9]. Sinus headache is marked in its alerting intensity and periodicity and acute sinusitis rapidly responds to antibiotic therapy [10]. The treatment of Sinus headache and other primary headache is very different [6]. Acute sinusitis is untreated can lead to a variety of Complications and needs a longer course of Antibiotics for resolution [10]. Stratification and separation of Sinus headache cases from other Neurological and primary headaches is imperative for any healthcare service. The following study aims to elucidate a diagnostic criterion for rapid diagnosis of acute sinusitis patients from a cohort of patients' in a general medical practitioners clinic or a medical clinic.

MATERIALS AND METHODS

From the cohort of patients who present in our Rhinology clinic, 112 patients were selected who were suffering from Acute or Chronic sinusitis. Symptoms lasting more than 12 weeks were classified under Chronic Rhinosinusitis (CRS), whereas those with shorter duration of illness were put under Acute Rhinosinusitis (ARS) [1]. Few cases, which were, Symptom-free intermittently (complete resolution) but lasting more than 12 weeks in total, were classified as Recurrent Acute Rhinosinusitis (RARS) [1]. The Initial History included the following:

This was followed by a regular E.N.T Clinical evaluation for Rhinosinusitis, on the guidelines established by the European Position Paper on Rhinosinusitis and Nasal Polyps 2012 criteria [1]. This is defined as Nasal blockage or Congestion or Nasal discharge at least one of the two, Facial pain/pressure and Reduced or absence of the sense of smell (Hyposmia /Anosmia). A history of a recent upper respiratory tract infection, fever, halitosis was enquired [7]. Further Anterior Rhinoscopy was done for Nasal discharge or Congestion or oedema of turbinates. This was confirmed by a Diagnostic nasal endos-

Ta. I. General History of Headache [3, 4, 5]

HEADACHE TIME OF ONSET
♦ Onset of headache seconds, minutes, hours, days ♦ Any precipitating Factors ♦ Weight lifting, sex, exercise, cold drinks, food consumption, lack of sleep, fever, exposure to flashes of light, psychological stress
Location of pain in the Cranium and face ♦ Unilateral or bilateral or alternating or no specific pattern
Duration of pain: ♦ migraine 4 or more hours, cluster headache<3 hours
Frequency and timing of attacks ♦ Cluster headache–multiple attacks per day, Frontal sinus headache/ Union headache
Pain severity **Quality of pain** ♦ Throbbing, stabbing, burning, Any paraesthesia of face or scalp ♦ Use of any medications for 3or more months (Medication Overuse headache) ♦ Variation in the intensity of pain (Variability) [9]

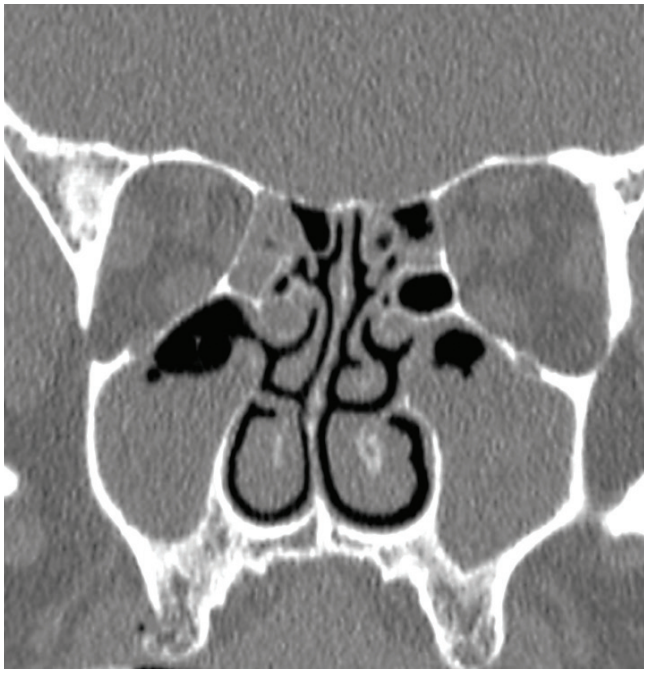

Fig. 1. Lund-McKay Grade 2 (Both Maxillary sinus) with Grade 1 (Both side ethmoidal) Sinusitis. This case had a total score of 9 and 11[2]. A total of 63 cases underwent Computed tomography scan of Para-nasal Sinuses for confirmation of Sinusitis or due to ambiguity of diagnosis.

Tab. II. Red Flags in Headache ("SNOOP") Criteria for exclusion [3, 4]

- Systemic symptoms (fever, weight loss) or Secondary risk factors (HIV, systemic cancer)
- Neurologic symptoms or abnormal signs (impaired alertness or consciousness, confusion)
- Onset: sudden, abrupt, or split-second
- Older: new-onset and progressive headache, especially in middle age (male, age greater than 50 years, higher risk for giant cell arteritis)
- Previous headache history: different headache (marked change in attack frequency, severity, or clinical features)

Tab. III. Character of Headache and Facial pain in Sinusitis

NR	SYMPTOMS	PERCENTAGE OF CASES
1. Acute Sinusitis N=63 cases	Unilateral Pain or Paraesthesia of the cheek	86% (54)
	Unilateral Frontal headache	81% (51)
	Throat pain	68% (43)
	Pain between the eyes	30% (19)
	Vertex headache	13% (8)
	Unilateral Temporal headache	11% (7)
	Unilateral Ear pain	8% (5)
2. Chronic Rhinosinusitis (CRS) 43 cases	Unilateral dull aching headache and facial pain (Any pain), Frontal, Temporal Maxillary or between the eyes, Bilateral pain was excluded, see discussion section	44% (19)
	Throat pain	37% (16)
3. Recurrent Acute Rhinosinusitis (RARS) Confirmed 11 cases	Unilateral dull aching headache and facial pain (Any pain), Episodic pain only Continuous Bilateral pain was excluded, see discussion section	100%

Tab. IV. Quality of Headache and Facial pain in Sinusitis

S. NR	SYMPTOMS [9]	PERCENTAGE OF CASES
1. Acute Rhinosinusitis N=63 cases	Unilateral Dull aching, variable intensity, continuous for few hours usually 4 to 6	95% (60)
	Unilateral Pain crescendo (Increasing) intensity from morning till afternoon	49% (31)
	Unilateral Pain increased when bending forward	34% (22)
	Unilateral Stabbing type of sharp pain	30% (19)
	Unilateral Feeling of heaviness of face	71% (45)
	Unilateral Paraesthesia or altered sensation of face	8% (5)
	Nonspecific pain	3% (2)
2. Chronic Rhinosinusitis (CRS) 43 cases	Unilateral Dull aching, episodic on and off	95,3% (41)
	Unilateral Paraesthesia or altered sensation of face	55,8% (24)
	Unilateral Dull aching, Continuous pain	13,9% (6)
3. Recurrent Acute Rhinosinusitis (RARS) Confirmed 11 cases	Unilateral dull aching headache and facial pain (Any pain), Episodic pain only Continuous Bilateral pain was excluded, see discussion section	100% (11)

copy under local anaesthesia, which demonstrated purulent discharge from the Middle meatus or other sinus ostia [3].The time duration of Symptoms of Acute post-viral rhinosinusitis is defined as an increase of symptoms after 5 days or persistent symptoms after 10 days with less than 12 weeks of duration following as per E.P.O.S 2012. Acute bacterial rhinosinusitis (ABRS) is defined as 'Double sickening" (Second syndrome) plus Systemic signs and purulent nasal discharge. E.P.O.S 2012 criteria of time duration of symptoms were thus checked for inclusion of cases.

Computed Tomography (CT Scan) of the Paranasal sinuses which is very useful in unambiguous confirmation of diseases was done when Acute bacterial rhinosinusitis (ABRS) was suspected or in cases where diagnosis was not obvious. Diagnostic criteria included the presence of more than 4-millimetre mucosal thickening in Paranasal sinuses. Lund-McKay Radiologic Sinusitis Grading system [2] was used to grade the extent of Sinusitis.

According to the available evidence in literature, currently Standard X-ray of Paranasal sinuses are inadequate to diagnose Rhinosinusitis, hence this was not done.

INCLUSION CRITERIA

Patient diagnosis was confirmed and classified into 3 types of Rhinosinusitis:

1. Acute Rhinosinusitis (ARS) Confirmed 63 cases included in this study
   - 10 patients fulfilling EPOS 2012 criteria for Acute Post-Viral Rhinosinusitis (APVRS) [1]
   - 53 patients fulfilling EPOS 2012 criteria for Acute Bacterial Rhinosinusitis (ABRS) – C.T scan imaging confirmation done in 21 cases [1]
2. Chronic Rhinosinusitis (CRS) Confirmed 43 cases included in this study C.T scan imaging confirmation done in 37 cases.

Tab. V. Diagnostic criteria for Sinus headache proposed with relevant Bio-statistical data

ACUTE RHINOSINUSITIS (ARS)	DIAGNOSTIC POINT OR TRAIT	SENSITIVITY OF CRITERION WITH P VALUE	SPECIFICITY OF CRITERION WITH P VALUE
Ostre zapalenie nosa i zatok przynosowych (ARS)	Dull aching pain of varying intensity, lasting on an average 4 to 6 hours	90.90% (Meaning, most Acute sinusitis cases can be diagnosed rapidly by this test) p=0.0034 at a 95% confidence interval (Alpha is 0.05)	21% (Meaning, many non-sinusitis patients will get diagnosed wrongly) p=0.018 at a 95% confidence interval
	Dull aching pain lasting on an average 4 to 6 hours and Previous history of a Common Cold within previous 2 weeks	95% (same) p=0.00992 at a 95% confidence interval	55% (same) p=0.0356 at a 95% confidence interval
	Unilateral character of Headache and facial pain	76% (same) p=0.042 at a 95% confidence interval	15% (same) p=0.0232 at a 95% confidence interval
Chronic Rhinosinusitis (CRS)	Unilateral dull aching headache and facial pain Episodic	16% p = 0,0092 przy 95% przedziale ufności	9% p=0.032 at a 95% confidence interval
Recurrent Acute Rhinosinusitis (RARS)	Too small sample size to be of any statistical significant result	p=5.98 at a 95% confidence interval not significant	

3. Recurrent Acute Rhinosinusitis (RARS) Confirmed 11 cases included in this study

C.T Scan confirmation was done in 5 cases.

This was the inclusion criteria of cases for this research.

EXCLUSION CRITERIA

The American Headache Society's SNOOP Criteria [3 and 4] was used in Screening of cases by our residents. Presence of any of the following signs or symptoms is a red flag and indicates the need to perform a more extensive evaluation.

RESULTS

The observations are described in the following sections:

Character of Headache and Facial pain

The most common type of pain was unilateral in most of the patients [7] which is strongly suggestive of Acute Sinusitis. The pain was most often localized to Frontal region or Cheeks or teeth.

Quality of pain in Sinus diseases

The following observations were made on patients regarding the quality of pain and headache.

DISCUSSION

The term "Sinus headache" is a dubious one, as the sinuses themselves are relatively insensitive to pain [7]. The most common types of headache and facial pain in clinics present in frontal, ocular, temporal or vertex region are easy to be erroneously concluded as caused by sinus pathology [11]. The International Classification of Headache Disorders, second edition

(ICHD-II) does not even attribute causation of headache to chronic sinusitis; chronic sinusitis is not a diagnosis to be made in any patient with pain. Orbital or retro-orbital pain, eye redness, rhinorrhea, nasal congestion, eyelid oedema, miosis, lacrimation, and facial congestion are seen in Cluster headache which can be easily misdiagnosed as Sinus pathology. These autonomic features are usually noted immediately after getting up from sleep, which is a diagnostic clue. Attacks happen in clusters, episodic pain attacks of 1 to 8 times per day followed by periods of remission, lasting months and even years, hence the name "Cluster" headache. These features are important diagnostic points.

Comprehensive bio-statistical evaluations were done using the PAST Statistical software package. A Confidence interval of 95% (p=0.05) was setup for the entire Hypothesis tested in this study. Analysis of variance test (ANOVA), Pearson's Chi-square test and linear regression modeling were employed in order to compare the observed traits according to demographic and clinical characteristics. When condition of normality of data was doubtful, we used a nonparametric test to compare two samples such as the Mann-Whitney. Members of the co-

hort were normal patients who were tested and found free of this disease. Student's t test using separate variance for two independent population means was used at a 95% confidence interval to conclude a statistical difference.

The most common cause of headache in clinical practice is Chronic Tension Type headache and Migraine. According to some study, 4 to 5% of general population suffers from Chronic Tension Type headache. The main diagnostic point of Chronic Tension Type headache is that the headache is Bilateral while Sinus headache in most cases is Unilateral or one-sided. However, the pain which is dull aching and continuous, accompanied by a feeling of heaviness, is exactly similar to Sinus headache.

An estimated 12% of the North American population suffers from some form of migraine [6], migraine headache is unilateral and accompanied by an Aura (Classic migraine) and most patients have a tumultuous attack of migraine which is in stark contest to insidious sinus headache. When Aura is absent (Common migraine), the pain of migraine is described as throbbing, with severe intensity, accompanied by photophobia. This picture is again much different from the Sinus headache. Pooling of data from other causes of headaches in clinics, in addition hospital data was used in the derivation of a diagnostic criteria. Sensitivity is defined as the ability of a test or criterion to correctly identify those who actually have a disease, while specificity is defined as the ability of a test to identify those persons who do not suffer from a disease or trait, but pass the test or criteria.

Keeping in view the broad contrast of symptoms, we would like to propose the following simple system diagnosis of Sinusitis.

CONCLUSION

- Unilateral, dull aching headache and facial pain of variable nature, persisting every day on an average of 4 to 6 hours, is a highly sensitive rapid superset criteria for the diagnosis of Acute sinusitis.
- This criteria if applied will also include many patients suffering from Acute Rhinosinusitis as defined by the E.P.O.S 2012 criteria.
- This, along with a history of previous Upper Respiratory tract infection, is useful to rapidly screen patients for Acute sinusitis.
- Though a subset of other headache cases will also get included by the criteria, hence imaging or Endoscopy must be done in these cases to increase the specificity of the criteria.

References

1. Fokkens W.J., Lund V.J., Mullol J. et al.: The European Position Paper on rhinosinusitis and nasal polyps 2012. Rhinology, 2012.
2. Lund V.J., Kennedy D.W.: Quantification for staging sinusitis. The Staging and Therapy Group. Ann. Otol. Rhinol. Laryngol. Suppl. 1995; 167: 17–21.
3. Dutto L., Meineri P., Melchio R. et al.: Nontraumatic headaches in the emergency department: evaluation of a clinical pathway. Headache. 2009; 49 (8): 1174–1185.
4. Lipton R.B., Dodick D., Sadovsky R. et al.: A self-administered screener for migraine in primary care: the ID migraine TM validation study. Neurology. 2003; 61 (3): 375–382.
5. William B.Y, Stephen D.S., Stephanie J.N, Michael J.M.: Young Diagnosis and Testing of Primary and Secondary Headache. Chapter 3, page 9–11. Jefferson Headache Manual, 2011; Demos Medical Publishing, ISBN 978-1-933864-70-9.
6. Lipton R.B., Bilal M.E., Diamond M. et al.: Migraine prevalence, disease burden, and the need for preventive therapy. Neurology. 2007; 68: 343–349.
7. Jensen R., Stovner L.J.: Epidemiology and comorbidity of headache. Lancet Neurol. 2008; 7 (4): 354–361. Doi:10.1016/S1474-4422(08)70062-0.
8. Rasmussen B.K., Jensen R., Schroll M., Olesen J.: Epidemiology of headache in the general population – a prevalence study. J. Clin. Epidemiol. 1991;44 (11): 1147–1157.
9. MaryAnn Mays Differential Diagnosis and Workup of the Headache Patient: Should I Order a Scan? Sinus Headache, Migraine, and the Otolaryngologist a Comprehensive Clinical Guide,1st Ed, Springer Intl 2017.
10. Benninger M.S., Ferguson B.J., Hadley J.A., Hamilos D.J., Jacobs M., Kennedy D.W. et al.: Adult chronic rhinosinusitis: Definitions, diagnosis, epidemiology and pathophysiology. Otolaryngology and Head and Neck Surgery. 2003; 129: S1–32.
11. Eross E., Dodick D., Eross M.: The Sinus, Allergy and Migraine Study (SAMS). Headache. 2007; 47 (2): 213– 224.

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DESERT NOSE SYNDROME (RHINITIS SICCA ANTERIOR) A NEW TYPE OF IRRITANT RHINITIS – A CLINICO-PATHOLOGICAL RESEARCH OF 93 CASES IN KUWAIT

Otorhinolaryngology

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ABSTRACT

In this clinico-pathological research we describe the "Desert nose syndrome" which is a unique disease in populations exposed to chronic desert environment, which leads to slow destruction of nasal muco-ciliary mechanism and progressive nose block. Though the clinical presentation is similar to Rhinitis sicca Anterior, this disease has unique clinical and endoscopic appearance. Computed tomography of the Para-nasal sinuses is strikingly normal throughout the course of disease and pathology fully confined only to nasal mucosa.

KEYWORDS

Non allergic perennial rhinitis, Rhinitis sicca anterior, Desert climate, Non-inflammatory, non-allergic rhinitis

Introduction

Rhinitis sicca anterior (Desert nose syndrome), a novel pathological condition met in patients of out-lying provinces of State of Kuwait. Desert nose syndrome is the result of chronic nasal exposure to very high temperature and extremely dry air, leading to chronic muco-ciliary damage and squamous metaplasia. Desert nose syndrome has a very unique clinical and endoscopic picture.

Background

Kuwait is a country nestled between Iraq and Saudi Arabia. Kuwait consists of predominantly desert type climate and sees little rainfall throughout the in summer temperatures range from 42 to 48 °C (108 to 118 °F) and peak summer temperature can reach up to 54.0 °C (129.2 °F) (CIA world book of facts). This is highest recorded temperature in Asia and also the third highest in the world (Wikipedia). Tumultuous Sand storms are frequent in March and April which are nothing but dry winds carrying huge quantities of fine dust. Most of the human population survives in this extreme climate by using Air conditioners. Entire buildings and shopping malls are air-conditioned.

Jahra lies on the route to the border town of "Abdali" and "Salmi", the predominant population of Jahra is "Bedouins", these are desert wandering nomads who travel from place to place (CIA world book of facts). Constant exposure to dust and heat leads to a peculiar syndrome complex of a unique type of Non-inflammatory, non-allergic rhinitis, Rhinitis sicca anterior – Desert nose syndrome.

Materials and Methods of research

This study was carried out in a private clinic of Jahra an out-lying province of Kuwait from June 2015 to August 2016 (12 months).From the pool of patients consulting our Rhinology clinic, Rhinoscopic evaluation, symptom assessment, and objective testing by Nasal Peak Inspiratory Flowmetry (NPIF) were used in Diagnosis of Desert nose syndrome. Nasal endoscopy was done on patients who had clinical history suspicious of this disease. This was followed up with NPIF. Radiological imaging like X-ray of Para nasal sinuses and a Computed tomography was done in select patients, especially who had clinical suspicion of chronic sinusitis or Nasal Sino-nasal polyp or fungal sinusitis.

Written and verbal consent was obtained before the investigations were carried out and permission of hospital ethical team was taken.

Type of study

This was a cross-sectional descriptive epidemiological type of study. Research was done in a hospital Rhinology clinic, and cases were analysed from cohort of patients presenting to the author with a variety of nasal complaints. A diagnostic picture was gradually formed by unusual clinical presentation of this Geo-pathological disease syndrome.

Observation

A total of 93 cases were studied to list out the clinical picture of this disease condition. The main symptoms of this condition were Nose block, Headache and dryness of nose. Occasional patient presented with anterior epistaxis, crusting and watery nasal-discharge. Sinusitis was excluded by absence of mucoid or purulent nasal discharge, Cough and Post-nasal drip. The main diagnostic clinical symptoms are shown in table 1a.

Table 1a. Clinical symptoms of Desert nose Syndrome, these are present for nine or more months each year

Symptoms of Desert nose syndrome	Percentage of patients	Number of cases
Nasal block	100%	93 / 93
Headache	95%	88 / 93
Dryness of nose	90%	84 / 93
Rhinorrhoea/ only watery discharge	80 %	74 / 93
Sneezing more than 5 times a day (Hansen B et al.,2002)	71%	66 / 93
Decreased sensation of smell	18%	17 / 93
Bleeding from the nose - Occasional	12%	11 / 93

In addition, Ophthalmological evaluation for Irritant conjunctivitis, medicine referral for presence of Bronchial Asthma and Dermatological evaluation for Atopy or Eczema was done. Height was measured in order to correlate with the Peak Nasal Inspiratory Flow score.

Rhinitis Quality of Life questionnaire was used in this study, all subjects completed a Sino-nasal Outcome Test or SNOT- 22 questionnaire (Ottaviano et al., 2014)(Hopkins C et al., 2009). We found the average SNOT-22 score was found to be 55, scores range is from 0 to 110, 22 question each carrying score of 0 to 5 (Zeiger RS et al.

1991).

Diagnostic Nasal Endoscopic Picture

The classical picture of Rhinitis sicca was absence of moist texture of mucosa of septal mucosa and anterior nasal cavity likened to "*desert*" in the nose. Mottling and multiple dots like adherence like *"sand-paper"* were seen in the mucosa. Sinusitis was excluded with absence discharge from any of the sinus meatus. Typical endoscopy findings are shown in figure number 1. This Endoscopic picture was found in all of the patients (100%).

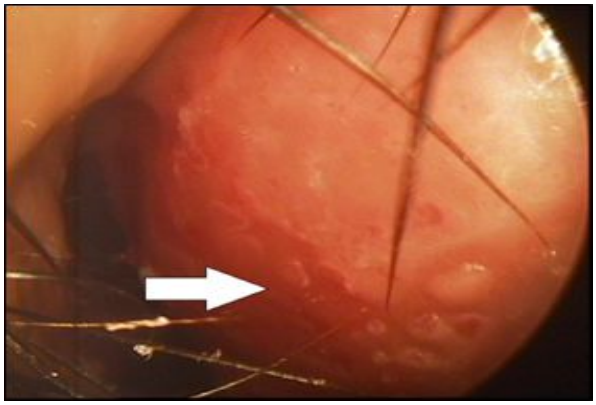

Figure1a. Typical patient with Dry looking septal mucosa in the nasal valve region looking like a "*desert*" in the nose with multiple dry mottled mucosa on the lower part of septum, "*sand-paper*" appearance are classical of this disease.

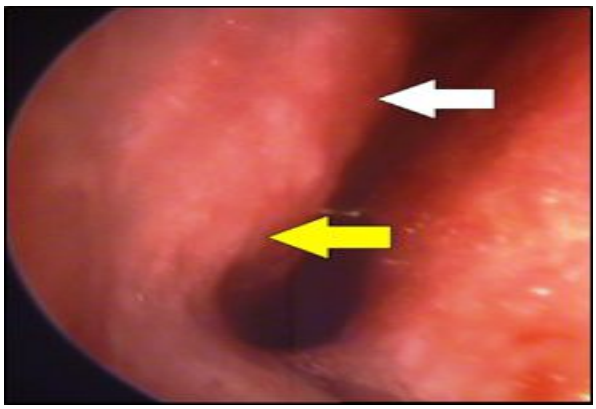

Figure1b. White arrow points to normal mucosa which looks moist, yellow arrow points to with Dry looking septal mucosa looking like a "*desert*" in the nose, with mottled "*sand paper*" appearance of septal mucosa on left. This is due to squamous metaplasia of the epithelium in the valve region.

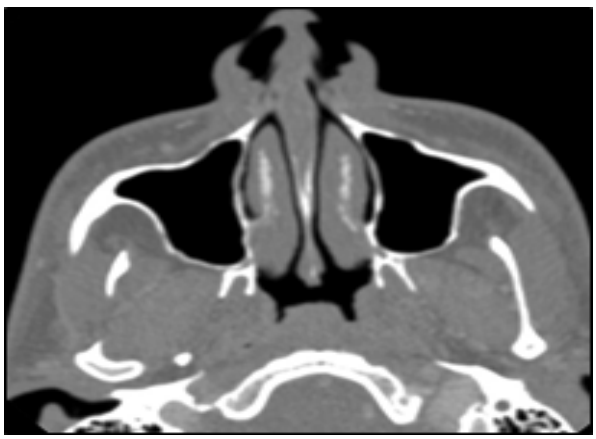

Figure1c. Computed tomography C.T image of a typical case, showing absence of any disease in the Maxillary antrum effectively differentiates this disease from any other Sinus disease. Only finding is the Inferior turbinate hypertrophy. This was found in all cases (100%)

Demographics of cases in our research

The demographic data of the cases and their Peak flow rate data, included in this study follow in Table2. Peak Nasal Inspiratory Flow rate was found to be markedly reduced from the population average from other similar research data (Ottaviano G et al., 2006). The population PNIF data of Kuwait population was not available, is left for future research. Total Eosinophil count was done to find systemic allergy.

Table 2 Mean age of cases with PNIF readings, which is the average of 3 consecutive measurements taken as per available research guideline on this investigation (Taylor G et al., 2014).

Demographic variable	Average
Mean age of presentation (Years)	23 years
Sex	75 males (81%) 18 females (19%)
Height of patient (centimetres)*	173 (centimetres)
PNIF (L/min) Peak Nasal Inspiratory Flow rate	100.56 L/min
Ethnicity	Kuwaiti 37% (34/93) Bedouins 33% (31/93) Saudi Arabians 18% (17/93) Others – Indians, Egyptians, Sri-Lankans 12 % (11/93)
Smokers	85 % (79/93)
Average reported age of onset of complaints (Togias 1990)	21.5 years
Total Eosinophil Count – Average (X 10^9)	220

* Height data is correlated with the Peak Nasal Inspiratory Flow rate, hence included (Ottaviano et al., 2014).

Histopathology of affected mucosa

Biopsy of the affected mucosa was done to characterize the histopathology of the lesion. Figure1d shows a photomicrograph of the affected mucosa showing keratinisation of columnar epithelium with a sub-mucosal inflammatory infiltrate, this is contrast to the traditional thought (Zeiger RS. 1991 et al. 1991) that Rhinitis sicca is a Non-inflammatory type of Rhinitis.

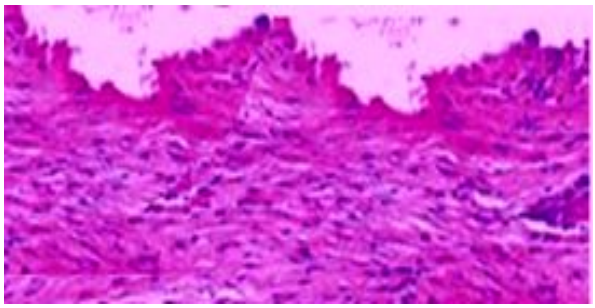

Figure1d. Histopathology of the affected mucosa showing squamous metaplasia with an inflammatory infiltrate, unlike traditional opinion of Rhinitis sicca (Zeiger RS. 1991 et al. 1991)

Statistical analysis

Various statistical tests were carried out using PAST Statistical software package. A Confidence interval of 95% (p=0.05) was setup for the entire Hypothesis tested in this study. Analysis of variance test (ANOVA), Pearson's Chi-square test and Linear regression modelling were employed in order to compare the NIPF according to demographic and clinical characteristics. When condition of normality of data was doubtful, we used a nonparametric test to compare two samples such as the Mann-Whitney. Members of the cohort were normal patients who were tested and found free of this disease. Student's t test using separate variance for two independent population means was used at 95% confidence interval to conclude statistical difference.

Discussion

Up to 50% of patients presenting in the Rhinology clinic may be suffering from some form of Non-allergic Rhinitis (Claus Bachert,

2008). The demographic characteristics of this study with 93 individuals, mostly males - n = 75 (80.6%) in relation to females n=18 (19.3%). Disease was common among Ethnic Kuwaiti population 37% cases, but since was carried out in a private hospital; this may be due to higher hospital bias. In our research, 79 individuals (85%) were smokers or had smoked more than 5 years, this was strongly statistically associated with this disease (p=0.0045). According to Togias A. (1990) Non allergic Perennial Rhinitis has a later age onset in contrast to Allergic Rhinitis which begins in childhood at typical age less than 20 years. Our study points out that the average age of onset of this condition is mean value of 21.5 years following a typical clinical picture of Non allergic Perennial Rhinitis.

Average Peak Nasal Inspiratory Flow rate (PNIF) value observed was 100.56 (n=93 Standard deviation was 46.3, compare mean 142.8 SD 27.9 degree of freedom is 31 Table t =2.576 data from ref (Ottaviano et al., 2014) was used this was not statistically significant. There is no significant difference in the nasal air flow in these cases. Total Eosinophil count did not show significant increase in this research.

With regards to clinical symptoms the diagnostic criteria is similar as that of Perennial Non-allergic Rhinitis, a prolonged history of more than 9 months (Claus Bachert, 2008) with predominant symptoms of nasal blockage, dryness of nose, watery discharge from nose, sneezing and headache. This is virtually indistinguishable from other causes of Non-allergic Rhinitis like Occupational and Hormonal rhinitis (Claus Bachert, 2008).

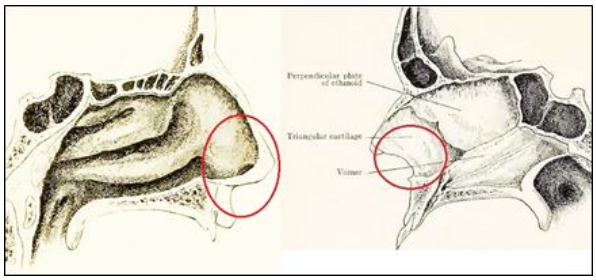

Figure2a. On the right is the cross-section of lateral wall of nose, on left cross-section of nasal septum, showing the areas predominantly affected in Desert nose syndrome. This is a Public domain images with modification.

The diagnostic endoscopy picture is where this disease entity stands as a unique one, with squamous metaplasia of columnar epithelium and mottling of the long standing metaplastic mucosa. Imaging modality serves to confirm that this is a pure rhinological disease process with all of the Para-nasal sinuses free of disease.

As per research of Feron CJ et al (1986), a variety of air pollutants can affect the mucosa of the nose, namely dry and hot air and fine sand. Sand particles are Silica or Silicon dioxide and are composed of particles of size ranging 0.0625 mm to 2 mm, as described by Geologists (Wikipedia page on sand). Crystalline silica dust is a known contributor to a variety of Lung diseases, characterized by inflammation of airways and scarring, which are described as Silicosis (Castranova V et al. 2000). Similarly, silica elicits inflammation and pathological metaplasia of nasal mucosa in Desert nose syndrome.

In addition pollen from flowers of Date palm (*Pheonix dactyfera* of Family : Arcaceae) can cause allergic symptoms like pollen allergy in rest of the world. In addition oil refineries in Kuwait release a variety of fumes like Poly aromatic hydrocarbons which can influence the heath of nasal mucosa. Petroleum distillates are known culprits to cause allergy (Dean M Clerico, 2001).

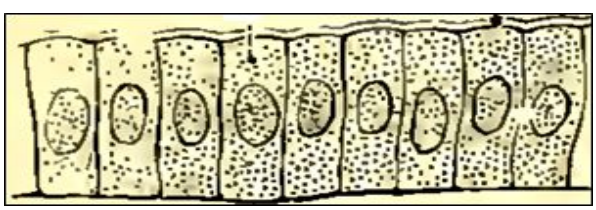

Figure2b. A Schematic picture showing columnar epithelium, with tall, cylindrical cells, are typical of respiratory mucosa lining the nose. This is a Public domain image.

According to Dean M Clerico (2001), Nasal respiratory epithelium on chronic exposure to Chemicals can undergo squamous metaplasia, Hyperkeratosis and Glandular hyperplasia. This is very much evident in Desert nose syndrome.

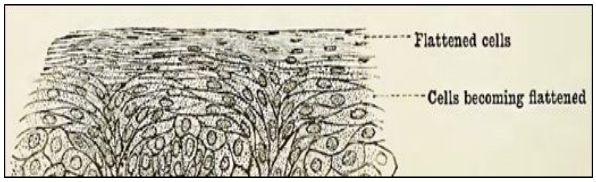

Figure2c. Schematic picture showing stratified, squamous epithelium, with flat cells in the outer layer and progressive keratinisation of cells. This is a Public domain image.

Suggested Treatment strategies

Traditional treatment of Rhinitis sicca is emollient sprays, Saline nasal sprays and emollient nasal ointments, aimed at reducing the dehydration of mucosa and promotes regeneration. Our study has found plenty of inflammation in sub-mucosa which means minimal use of inhaled Nasal corticosteroid sprays would promote restoration of columnar respiratory mucosa. But inhaled corticosteroids themselves promote dryness of mucosa, hence must be dosed judiciously. Efficacy of these various treatments is left for further future analysis.

Conclusion

Desert nose syndrome is a unique condition resulting from chronic unprotected exposure to high temperature, fine sand and dry hot air of the desert, this condition is characterized by chronic nasal blockage and dryness of nose. Nasal endoscopy picture is remarkable with squamous metaplasia of valve area and septal mucosa, hyperkeratosis and glandular hyperplasia. Unique sub-mucosal inflammation was noted. Minimal use of inhaled Nasal corticosteroids could be beneficial in presence of inflammation.

References

1. Jeff Maste on Geography of Kuwait
a. Retrieved from http://www.wunderground.com/blog/JeffMasters/article.html
2. Wikipedia page on Geography of Kuwait a.Retrieved from https://en.wikipedia.org/w/index.php?title=Geography_of_ Kuwait&oldid=777155419
3. Wikipedia page on Sand
4. Retrieved from https://en.wikipedia.org/wiki/sand
5. Bardana EJ. Occupational asthma and related respiratory disorders. Disease-a-Month. 1995; 41: 143-9
6. CIA World book of facts
7. Retrieved from https://www.cia.gov/library/publications/the-world- factbook/geos/ku. html
8. Ottaviano, Giancarlo & Scadding, Glenis & Coles, Stuart & Lund, Valerie. (2006). Peak nasal inspiratory flow; normal range in adult population. Rhinology. 44. 32-5.
9. Ottaviano, Giancarlo & Lund, Valerie & Nardello, Ennio & Scarpa, Bruno & Mylonakis, Ioannis & Frasson, Giuliana & Iacono, Valentina & Manzato, Enzo & Marioni, Gino & Staffieri, Alberto. (2014). Peak nasal inspiratory flow: A useful and handy tool for the diagnosis of nasal obstruction in the elderly. Archiv für Klinische und Experimentelle Ohren- Nasen- und Kehlkopfheilkunde. 271. 2427-31. 10.1007/s00405-013-2875-4.
10. Taylor G, Macneil AR, Freed DLJ (1973) Assessing degree of nasal patency by measuring peak expiratory flow rate through the nose. J Allergy Clin Immunol 52: 193-198
11. Hopkins C, Gillett S, Slack R, Lund VJ, Browne JP (2009) Psychometric validity of the 22-item Sinonasal Outcome Test. Clin Otolaryngol 34:447–454
12. Ottaviano, Giancarlo & Lund, Valerie & Nardello, Ennio & Scarpa, Bruno & Frasson, Giuliana & Staffieri, Alberto & Scadding, Glenis. (2014). Comparison between unilateral PNIFand rhinomanometry in healthy and obstructed noses. Rhinology. 52. 25-30. 0.4193/Rhino13.037.
13. Dean M Clerico in Disease of the Sinusis Diagnosis and Management Chapter 9 Environmental Influence on Sinus Disease: the Role of Chemical Air Pollutants B.C. Decker Inc. 2001 pages:107 to 117
14. Feron VJ, Woutersen RA, Spit BJ. Pathology of chronic nasal toxic responses including cancer. In: Barrow CS, editor. Toxicology of the nasal passages Washington, DC: Hemisphere Publishing; 1986.
15. Hansen B, Mygind N. How often do- normal persons sneeze and blow the nose? Rhinology. 2002; 40: 10-2.
16. Claus Bachert in Scott and Brow Scott-Brown's- Otorhinolaryngology Head and Neck Surgery 7th Edition Chapter 110 Non-allergic Perennial Rhinitis vol 2 2008;1408-1414
17. Togias A. Age relationships and clinical features of nonallergic rhinitis. J Allergy

Clinical Immunology 1990; 85:182.
18. Zeiger RS. Differential diagnosis and classification of rhinosinusitis. In: Schatz M, Zeiger
19. RS, Settipane GA, eds. Nasal Manifestations of Systemic Diseases. Providence, RI:
20. OceanSide Publications, Inc., 1991:3–20. Hopkins C, Gillett S, Slack R, Lund VJ,
21. Browne JP. Psychometric validity of the 22-item Sinonasal Outcome Test. Clinical
22. Otolaryngol. 2009; 34: 447-454.
23. Castranova V, Vallyathan V: Silicosis and coal workers' pneumoconiosis.
24. Environ Health Perspect 108 (Suppl 4):675, 2000

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Radiological profiles of nasopharyngeal anatomy as seen in computed tomography scans of normal patients undergoing brain scans for other neurological problems in Konkani population

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ABSTRACT

Background: Nasopharyngeal carcinoma arises from interactions between underlying genetic and racial predilection and variety environmental factors. It is locally aggressive and presents with occult cervical nodal metastasis. A thorough understanding of radiological regional anatomy of the nasopharynx in Indians particularly Konkani population is important for early detection of nasopharyngeal carcinoma.
Methods: Routine computed tomography of brain, head and neck for other neurological problems like stroke clearly delineates the loco-regional anatomy of the nasopharynx. Computed tomography (CT) images stored in the computer system were studied to delineate the normal loco-regional anatomy of nasopharynx with special reference to anatomical structure of fossa of Rosenmueller and to find out the normal dimensions of nasopharynx in Konkani population. Nasopharyngeal carcinoma is a hidden and cryptic killer with relatively higher incidence among young population. To develop a local screening CT program for earlier detection of this occult malignancy was another purpose of this endeavour.
Results: Internal carotid artery lies at the depth of around 1 to 1.7 cm from floor of lateral pharyngeal recess (fossa of rosenmuller); this figure has to be borne in mind while doing invasive procedures of nasopharynx like biopsies and adenoidectomy.
Conclusions: Posterior pharyngeal wall thickness of more than 2.4 cm and adenoid mass extending to posterior margin of the medial pterygoid plate is suspicious of malignancy. A screening protocol of CT nasopharynx has been suggested as a fruit of this endeavour.

Keywords: Multidetector computed tomography, Nasopharynx, Anatomy, Nasopharyngeal carcinoma

INTRODUCTION

Nasopharynx in the pre-endoscopic era was termed as the "Pandora's box" of Otorhinolaryngology due to inaccessibility and poor visualization. Most Nasopharyngeal diseases have been traditionally been under diagnosed. There are a variety of conditions like acute otitis media, nasopharyngeal carcinoma, choanal atresia, obstructive sleep apnoea, cleft palate, dental overbite/malocclusion, anosmia and cleft palate which are associated with the nasopharyngeal dimensions.[1] In this research we explore the anatomy of the nasopharynx using radiological images.

The aims and objectives of this study were to delineate the normal loco-regional anatomy of nasopharynx with special reference to anatomical structure of fossa of

Rosenmueller and further, to chart out the normal dimensions of nasopharynx in Konkani population.

Nasopharynx has been studied using a variety of techniques like dye injection, rhinomanometry with the pressure-flow technique, X-rays and magnetic resonance imaging (MRI).[2] High arched palate and deviated nasal septum as a consequence of adenoid hypertrophy are described in the spectrum of adenoid facies and chronic mouth breathing.[3] Hypo and hypernasality of speech are functional problems encountered in ENT clinic due to decreased and increased nasal resonance respectively. Up to 60% of patients with cleft lip and palate suffer from hyper-nasality and compromised naso-pharyngeal airway, with resultant mouth-breathing and adverse effect on the craniofacial development.[4] This adenoidal hypertrophy causes nasopharyngeal airway obstruction which leads mouth breathing, as a result of nasal obstruction.[5] This has adverse effects on the normal naso-maxillary development. The correlation between nasopharyngeal dimensions size and the adenoid pad is of vital importance.[6] CT is available in our rural hospital and provides vital information about the extent and character of mass lesions. In known tumours like juvenile nasopharyngeal angiofibroma of nasopharynx, CT is used to determine the extent of bony invasion, the compression and invasion of the tumour into vital structures like Internal carotid artery and brain, and the involvement of loco-regional lymph nodes like retro-pharyngeal and para-pharyngeal lymph nodes. Additional wealth of information can be obtained by using intravenous contrast because enlarged lymph node may be difficult to differentiate from the surrounding soft-tissue especially inflamed tissues. Renal failure and contrast allergy are contraindications to the use of contrast.[7]

METHODS

Study design

This was a cross sectional descriptive epidemiological, non-randomized trial, unicentric type of study in hospital setting to delineate the loco regional and radiological anatomy of nasopharynx in Konkani population.

Study place and duration

Study place was carried out in Department of E.N.T, B.K.L Walawalkar Rural Medical College Hospital from 25 November 2018 to 24 March 2019 (3 months 27 days).

Selection criteria of the patients

Routine computed tomography of brain, head and neck for other neurological problems like stroke clearly delineates the loco-regional anatomy of the nasopharynx. Extremes of ages (>60 years and <14 years of age were excluded from this study). Existing head and neck pathology cases were also excluded from this study.

Procedure

A wealth of such images data is available on the Computer database of our institute. This was utilized and a reasonable picture of radio-anatomy of nasopharynx in Konkani population can be inferred at no cost or risk to the patients. Nasopharyngeal carcinoma is a hidden and cryptic killer with relatively higher incidence among young population. To develop a local screening computed tomography (CT) program for earlier detection of this occult malignancy was another purpose of this endeavour.

CT scan of nasopharynx was performed with a maximum slice thickness of 5 mm. If any pathology was detected thinner slices were ordered to delineate the extent of pathology. As a standard practice, if contrast was found necessary, a contrast bolus of 100 ml was given intravenously after test dose with a time-delay of 1 minute. Any patient with middle ear effusion was diligently evaluated for mass in the nasopharynx that could lead to Eustachian tube dysfunction, causing an effusion.

Ethics committee approval

Ethical guidelines of the institutional research committee were followed and committee's formal approval was obtained before embarking on this research. Additional informed consent was obtained from all individual participants for whom any identifying information is included in this article.

Methodology of CT evaluation of normal nasopharyngeal anatomy

Study population

We chose 100 normal patients who did not have any findings physical examination of the nasopharynx and no clinical suspicion of nasopharyngeal disease. These patients underwent CT of brain for reasons unrelated to the nasopharynx. All of the studies were done on General Electric Company's Brivo CT385, 16 slices which is available in our hospital. Study was carried out from 25 November 2018 to 24 March 2019. C.T images on computer records database were accessed from 01 January 2016 to 15 March 2019. Standard axial scans were studied at 5 mm intervals with the infraorbial, Reid's meatal line perpendicular to the plane of the table. Current for such a study was set to 10 mA, slice thickness 1.25 and resolution at 1024×512 pixels. Patients are routinely asked to open their mouth widely or do a Valsalva manoeuvre, the resulting air distension of nasopharynx is helpful in air-soft tissue contrast outlining of the eustachian tubes and lateral pharyngeal recesses (fossa of Rosenmuller).

Clinical characteristics of the study participants

Dimensions of nasopharynx were calculated by the following protocol, anterio-posterior length of nasopharynx was calculated at the maximum distance between the anterior and posterior walls mucosal edges in sagittal images. The width and height of nasopharynx measured in the coronal and axial images.[8] The measure of anteroposterior nasopharyngeal dimension was measured as the distance between the posterior hard palate edge and the superior pharyngeal constrictor muscle. The greatest distance between mucosa on left and right medial pterygoid plates was measured and quantified as width of the nasopharynx.

One quick way of identification of fundus of lateral pharyngeal recess (fossa of Rosenmuller) in axial cuts was to look for dumbbell like appearance of the condyle and coronoid process of the mandible, separated by the mandible notch. This is a unique finding of this study and named as "Dumbbell sign of fundus" of lateral pharyngeal recess (fundus appears like a dot or a bubble). This was observed in almost all axial images as depicted in the CT image.

Oon's method of measurement of soft-tissue thickness of the posterior wall of nasopharynx was used. This method was used in X-ray films but can be extrapolated with increased sensitivity for CT images. The soft-tissue thickness of the posterior wall of nasopharynx is measured from a line connecting posterior edge of the soft palate to the anterior lip of the foramen magnum (Basion).[9]

Bio-statistical analysis

All the bio-statistical analysis was done with done using the PAST Paleontological statistics software package for education and data analysis package. A confidence interval of 95% (p=0.05) was setup for the entire Hypothesis tested in this study. Analysis of variance test (ANOVA), Pearson's Chi-square test and linear regression modelling were employed in order to compare the observed traits according to demographic and clinical characteristics. When condition of normality of data was doubtful, we used a nonparametric test to compare two samples such as the Mann-Whitney.[10]

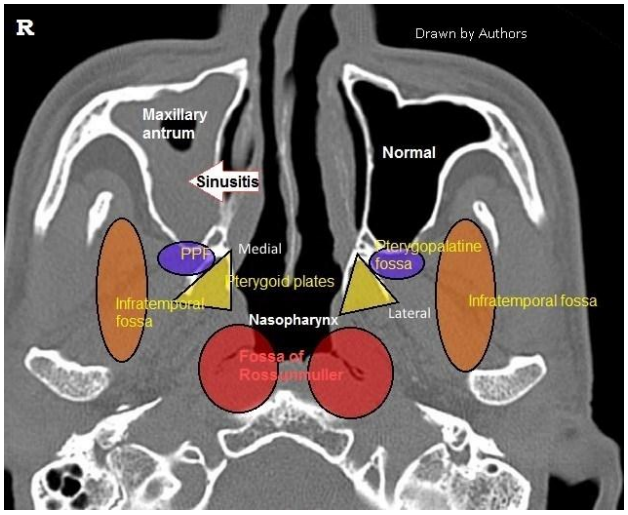

Figure 1: Normal regional anatomy of the nasopharynx with lateral pharyngeal recess (fossa of Rosenmuller) and showing adenexal structures like pterygopalatine fossa, infra-temporal fossa; this patient has right maxillary sinusitis.

RESULTS

The following measurement and observation were made in the CT images of the selected cases. Visible air in the Eustachian tube is normal and was seen in axial cuts during quite respiration to maximum 4 mm was seen only in 8 cases. This is not of any clinical significance.

Mean age of patient included in this study was 53.324±7.31 years, the median age was 55 years. There is a bias towards elderly population as these are more likely to get a CT scan of the brain. 63 males and 37 females were included in this study. Mean depth of nasopharynx at the level of Dumbbell's sign or fossa of Rosenmuller was found to be 20.3894±1.44 mm, length (width) of nasopharynx was found to be 26.93706±1.922 mm and height of nasopharynx was detected to be 20.176±0.650 mm. The depth and width were not statistically significant from the average mean of population. Konkani population has similar depth and width dimensions, while height dimension is statistically different from world average (at p value of 1.206×10^{-20} <<0.05).

Table 1: Baseline demographic characteristics.

Name of variable and comment	Observed value
Age of patients included in this study (Statistically normalized for any age bias due to CT scan of brain more common in elderly)	Mean age 53.324±7.31 years (1.96 × standard error) Kurtosis -1.15048 Median age 55 years
Sex of the patients	63 males and 37 females
Urban versus rural population from our medical records	88% rural Konkani populations
Level of education	3% post graduate, 7% college graduate, 13% high school, 67% illiterate population
Language of communication	90% Marathi, 6% Konkani, 4% Hindi and others

Table 2: Observed computed tomographic data for normal nasopharynx.

Name of variable and comment	Clinical findings
Anteroposterior (depth) dimension of nasopharynx at the level of Dumbbell's sign or fossa of Rosenmuller (mean data is available in literature)[8]	Average 20.3894±1.44 mm
Lateral dimension (width) of nasopharynx at the level of Dumbbell's sign or fossa of Rosenmuller	Average 26.93706±1.922 mm
Height dimension of nasopharynx at the same level in coronal CT images	Average 20.176±0.650 mm
Dimension of right lateral pharyngeal recess (fossa of Rosenmuller)	Average 11.156±1.04 mm
Dimension of left lateral pharyngeal recess (fossa of Rosenmuller)	Average 10.367±1.02 mm
Depth of right internal carotid artery from floor of the right lateral pharyngeal recess (fossa of Rosenmuller)	Average 9.883±0.82 mm
Depth of left internal carotid artery from floor of the right lateral pharyngeal recess (fossa of Rosenmuller)	Average 9.735 ±0.72 mm
Mucosal thickness of nasopharyngeal vault posterior wall	Average 17.31±3.104 mm

Table 3: Outcome with bio-statistical inferences from our data.

Name of variable and comment	Biostatistical analysis Alpha level at p=0.05	
Anteroposterior (depth) dimension of nasopharynx at the level of Dumbbell's sign or fossa of Rosenmuller (mean data is available in literature)	One sample t test (Given mean 21.80714) Calculated p=0.06687 >0.05 Not statistically significant	
Lateral dimension (width) of nasopharynx at the level of Dumbbell's sign or fossa of Rosenmuller	One sample t test (Given mean 25.31951) Calculated p=0.1086 >0.05 Not statistically significant	
Height dimension of nasopharynx at the same level in coronal CT images	One sample t test (Given mean 19.4619) Calculated p=2.615×10^{-24}<<0.05 Statistically significant	
Dimension of right lateral pharyngeal recess (fossa of Rosenmuller)	One sample t test Calculated p=1.206×10^{-20} <<0.05 Statistically significant	Right and Left data two independent sample F and t tests p=0.29239>0.05 No statistical difference between right and left side measurements
Dimension of left lateral pharyngeal recess (fossa of Rosenmuller)	One sample t test Calculated p=5.58×10^{-20} <<0.05 Statistically significant	
Depth of right internal carotid artery from floor of the right lateral pharyngeal recess (fossa of Rosenmuller)	One sample t test Calculated p=2.981×10^{-22} <<0.05 Statistically significant	Right and left data two independent sample F and t tests p=0.79142>0.05 No statistical difference between right and left side measurements
Depth of left internal carotid artery from floor of the right lateral pharyngeal recess (fossa of Rosenmuller)	One sample t test t=26.46 Calculated p=8.503×10^{-24} <<0.05 Statistically significant	
Mucosal thickness of nasopharyngeal vault posterior wall	One sample t test t=14.2 Calculated p=1.288×10^{-15} <<0.05 Statistically significant	

Depth of right or left internal carotid artery from floor of the lateral pharyngeal recess was found to be 9.883±0.82 mm and 9.735±0.72 mm respectively. This is surgically important as injury to internal carotid is fatal in procedures of nasopharynx like biopsy or adenoidectomy. Mucosal thickness of posterior wall is clinically important for detection of early, especially sub-mucosal malignancy, which may appear as a localized area of thickness. This study found that the average value of mucosal thickness was average 17.31±3.104 mm on the posterior wall of nasopharyngeal vault. It can be inferred that upper limit of mucosal thickening is 20.414 mm in the posterior pharyngeal wall; any value beyond this is suspicious.

DISCUSSION

Normal nasopharynx is described as an inverted J-shaped muscular-aponeurosis hung from the central regions of the cranial base.[13] The roof of the nasopharynx is limited by basisphenoid, posterior-inferior by the bony clivus. Anteriorly it continues as nasal cavity, and inferiorly the soft-palate. C1-C2 vertebral disc is the radiological boundary between the nasopharynx and oropharynx. Roof of nasopharyngeal has the foramen lacerum through which the principal skull base invasion of nasopharyngeal carcinoma occurs.

The pharyngobasilar fascia which is the tough aponeurosis that extends upwards from the superior constrictor to medial pterygoid plate and skull base. This fascia is responsible for structural integrity of the nasopharynx and resists invasion by tumour. Pharyngobasilar fascia separates superficial muscle planes from deeper muscle planes. Superior constrictor muscle is attached to the (=basal tubercle) pharyngeal tubercle of the basiocciput bone. Sinus of Morgagni is a defect in the fascia for entry of Eustachian tube and Levator veli palatine. Torus tubarius or tubal elevation is an inverted "J" shaped elevation in the nasopharynx caused by the cartilaginous end of the Eustachian tube. This appears more slightly radio-dense in C.T images than surrounding soft tissue due to its calcium content. The Eustachian tube orifice is trumpet-shaped and seen anterior to torus tubarius on axial images. Levator palati muscle is the major contributor to muscular soft tissue planes of nasopharynx. Passavant's muscular ridge is seen U-shaped sub-mucosal density about 1.5 cm below the torus tubarius, these muscles act as a sphincter during swallowing closing off nasopharynx to prevent nasal regurgitation of food.

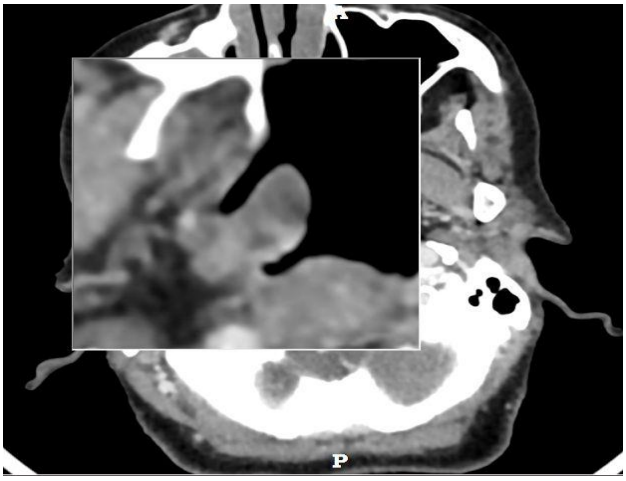

Figure 2: A normal right side torus tubarius; the radio-dense nature of torus tubarius in CT images than surrounding soft tissue due to its calcium content.

Normal loco-anatomy of lateral pharyngeal recess (fossa of Rosenmuller) observed.

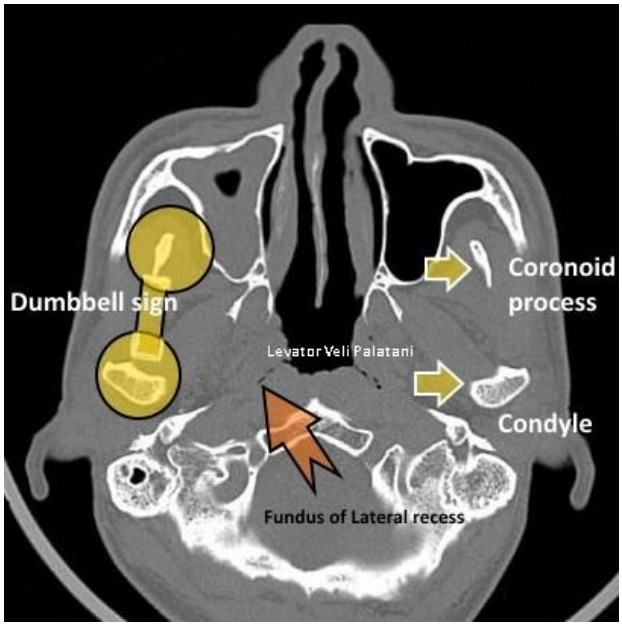

Figure 3: Dumbbell sign of fundus of lateral pharyngeal recess; a quick way of identification of fundus of lateral pharyngeal recess (fossa of Rosenmuller) in axial cuts was to look for Dumbbell like appearance of the condyle and coronoid process of the mandible, separated by the mandibular notch.

The lateral pharyngeal recess (fossa of Rosenmuller) is seen posterior to the torus tubarius in axial cuts. Some degree of asymmetry of lateral pharyngeal recess is normal in healthy individuals. Fossa of Rosenmuller is thought to be formed due mucosa reflection over the Longus colli muscle. Invasion of Longus colli muscle or Levator palati muscle is a sign of malignancy. The shape and depth of the fossa of Rosenmuller is dependent on muscle bulk and mucosal thickness. In elderly the loss of muscle mass results in wide and shallow fossa adding to the needed contrast for evaluation of growths that arise in this region.

Parapharyngeal space which lies in the lateral relation of nasopharynx, is a potential area for invasion or expansion of tumours of this region. Obliteration of the normal fat pads is sign of tumour invasion into these adjacent area Parapharyngeal space or pterygopalatine fossa.[14] Retropharyngeal nodes which are the first echelon nodes which drain the Nasopharynx are clinically inaccessible. They were seen in few cases as discrete 3-5 mm nodes.[15] Direct extension sphenoid sinus and infra-temporal fossa is also seen.

Adenoid hypertrophy adenoids grow and reach a maximum size by 5 years of age and by late 30 years should have totally disappeared. After 10 years of age, it is highly uncommon for the adenoids to reach up to the posterior margin of the bony medial pterygoid plate. If such a swelling is visualized on CT scan of an elderly patient further investigation to rule out nasopharyngeal carcinoma is definitely indicated.[16]

Nasopharyngeal carcinoma

Nasopharyngeal carcinoma appears iso-dense to muscle on non-enhanced CT image. There is minimal tumour enhancement is often seen following intravenous contrast. The earliest radiological manifestation of nasopharyngeal carcinoma is an increase in the width of the soft tissue of the wall of nasopharyngeal vault. Our research has delineated the normal soft tissue mucosal wall thickness in Konkani population at a 17.31±3.104 mm. In previous studies in literature the soft tissue mucosal wall follows the contours of the underlying bone and pre-vertebral muscles especially longus colli and has a thickness that rarely exceeds 1.5 cm.[17] This nominative data can be used for screening populations for this occult malignancy. This data is unique for population of this region (Northern-west coast of India) of country and appears first time in literature.

Table 4: Screening for nasopharyngeal growths in Konkani population- Dervan protocol.

Component	Criteria for normalcy in Konkani population
Soft tissue mucosal wall thickness in Konkani population on axial CT scan as measured at	Upper limit of mucosal thickening 20.414mm in the posterior pharyngeal wall
Adenoidal mass to extend up to the posterior margin of the medial pterygoid plate	Suspicious mass in nasopharynx
CT rescan with a "pinched nose" modified Valsalva manoeuvre or with mouth widely open (to show the pliability of normal lymphoid tissue)	Change in findings
Contour of soft tissue mucosal wall and deep muscle planes	Follows the contour, altered, does not follow the contour mild alteration of contour
Erosion of structures	Pterygoid plates, clinoid process, clivus, foramen lacerum especially cartilage in the inferior part; erosion of greater sphenoid wing
Lymphatic spread	Lateral or medial retropharyngeal lymph nodes

The validity, sensitivity and specificity of this protocol have to be validated by further studies in this region and will be subject of subsequent paper.

Mean depth of nasopharynx at the level of or fossa of Rosenmuller was found to be 20.3894±1.44 mm, length (width) of nasopharynx was found to be 26.93706±1.922 mm and height of nasopharynx was detected to be 20.176±0.650 mm. Compared to data in the literature the depth and width were not statistically significant from the average mean of world population.[18] Konkani population has similar depth and width dimensions, while height dimension is statistically different from world average (at p value of 1.206×10^{-20} <0.05) as compared with world data in literature. Depth of right or left internal carotid artery from floor of the lateral pharyngeal recess was found to be 9.883±0.82 mm and 9.735±0.72 mm respectively.[19] This study found that the average value of mucosal thickness was average 17.31±3.104 mm on the posterior wall of nasopharyngeal vault. It can be inferred that upper limit of mucosal thickening is 20.414 mm in the posterior pharyngeal wall as compared to previous literature values; any value beyond this is suspicious.[20]

Clinical insights

Internal carotid artery lies at the depth of around 1 to 1.7 cm from floor of lateral pharyngeal recess (fossa of Rosenmuller); this figure has to be borne in mind while doing invasive procedures of nasopharynx like biopsies and adenoidectomy.[21] Posterior pharyngeal wall thickness of more than 2.4 cm and adenoid mass extending to posterior margin of the medial pterygoid plate is suspicious of malignancy.[22]

CONCLUSION

Posterior pharyngeal wall thickness of more than 2.4 cm and adenoid mass extending to posterior margin of the medial pterygoid plate is suspicious of malignancy. A screening protocol of CT nasopharynx has been suggested as a fruit of this endeavour.

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REFERENCES

1. Renko M, Kristo A, Tapiainen T, Koivunen P. Nasopharyngeal dimensions in magnetic resonance imaging and the risk of acute otitis media. J Otol Laryngol. 2017;121(9):853-6.
2. Ward FW, McNicholas WT. Clinical prediction of the sleep apnea syndrome. Sleep Med. 1997;1(1):19-32
3. Todd TW. Integral growth of pace: I. The nasal area. Am J Orthdontia Oral Surg. 1936;22(4):321-34.

4. Hairfield WM, Warren DW. Dimensions of the cleft nasal airway in adults: a comparison with subjects without cleft. J Cleft Palate. 1989;1:9-13.
5. Bresolin D, Shapiro PA, Shapiro GG, Chapko MK, Dassel S. Mouth breathing in allergic children: its relationship to dentofacial development. Am J Orthod. 1983;83(4):334-40.
6. Fujioka M, Young LW, Girdany BR. Radiographic evaluation of adenoidal size in children: adenoidal-nasopharyngeal ratio. Am J Roentgenol. 1979;133:401-4.
7. Teresi LM, Lufkin RB, Vinuela F. MR imaging of the nasopharynx and floor of the middle cranial fossa—part I: Normal anatomy. Radiology. 1987;164:811-6.
8. El-Anwar MW, Ali AH, Elnashar I, Elfiki IM, Ahmed AF, Abdulmonaem G. Normal Nasopharyngeal Measurement by Computed Tomography in Adult. J Craniofac Surg. 2017;28(4):395-8.
9. Oon CL. Some sagittal measurements of neck in normal adults. Br J Radiool. 1964;1(37):674-7.
10. Øyvind H, Harper David AT, Ryan Paul D. PAST: Paleontological statistics software package for education and data analysis. Palaeontologia Electronica. 2001;4(1):9-10.
11. Mancuso AA, Bohman L, Hanafee W, Maxwell D. Computed Tomography of the Nasopharynx: Normal and Variants of Normal. Radiology. 1980;137:113-21.
12. Feinstein AR. Clinical epidemiology the architecture of clinical research. Philadelphia; Saunders publishers: 1985;10:111-45.
13. Teresi LM, Lufkin RB, Vinuela F. MR imaging of the nasopharynx and floor of the middle cranial fossa-part I: Normal anatomy. Radiology. 1987;164:811-6.
14. Chong VFH, Fan YF. Radiology of the nasopharynx: Pictorial essay. Aust Radiol. 2000;44:5-13.
15. Mancusco AA, Harnsberger HR, Muraki AS, Stevens MH. Computed tomography of cervical and retropharyngeal lymph nodes: Normal anatomy, variants of normal, and applications in staging head and neck cancer. Part I. Normal anatomy. Radiology. 1983;148:709-14.
16. Mukherji SK, Weissman JL, Holliday R. The pharynx. In Head and Neck Imaging;H, C, Ed.; Mosby: New York, 1996;6:437-488.
17. Bloch S, Danziger J. Radiological experience with nasopharyngeal masses. J South African Med. 1973;47:2380-3.
18. Dickson RI, Flores AD. Nasopharyngeal carcinoma:an evaluation of 134 patients treated between 1971-1980. Laryngoscope. 1985;95:276-88.
19. Zeng Y. Seroepidemiological studies on nasopharyngealcarcinoma in China. Arch Cancer Res. 1985;44:121-38.
20. Woo J, Sham CL. Diagnosis of nasopharyngeal carcinoma. Ear Nose and Throat Journal. 1990;69:241-2.
21. Lam WW, King AD, Ahuja AT, Metreweli C. Imaging. In: vanHasselt CA, Gibb AG(eds). Nasopharyngeal carcinoma, 2nd edn. Hong Kong: Chinese University Press; 1999: 127-160.
22. Waldron J, Kreel L, Metreweli C, Woo JKS, Van Hasselt CA. Comparison of plain radiographs and computed tomographic scanning in nasopharyngeal carcinoma. Clin Radiol. 1992;45:404-6.

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CASE REPORT

Prolonged Impacted Partial Denture in the Oropharynx during Pregnancy and Insights into Its Management- A Case Report

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Abstract:

A Partial denture is a problematic foreign body with high morbidity associated with removal. This is due to presence of sharp and curved clasp which can easily pierce and embed into the soft tissue. Any overzealous and forcible attempt at removal can lead to rupture of the hollow organ like Oesophagus with a fatal outcome.

Endoscopic removal of Denture must be attempted only in the Operation theatre. Excellent Anaesthesia and good visualization of the foreign body are mandatory for successful removal. Attempt must be made with a sound understanding of the shape of the denture and location of its embedding, forcible extrication without vision is never to be undertaken.

Key words:

Foreign body, Partial Denture impaction, Laryngoscopy, Rigid endoscopy

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Introduction:

Accidental ingestion of Partial denture is a dangerous problem in Otorhinolaryngology practice. It is usually seen in elderly patients but people are more likely to ingest or aspirate dentures, if consciousness is impaired by various reasons like alcoholic intoxication, seizures, drug addiction or general anaesthesia. [(1)]

Case report:

A twenty seven (27) year old, seven month gravida presented to our casualty department with history of accidental ingestion of partial denture of upper jaw frontal teeth. Allegedly, two days ago she developed giddiness while walking inside her home, she fell on the floor and found her denture missing. She could not confirm that she swallowed it as she was unconscious. She consulted a local general practitioner, who referred her to the clinic of the local Otorhinolaryngologist.

Patient consulted the local Otolaryngology specialist who did an Indirect Laryngoscopy and noted that the foreign body was impacted in the Vallecula (Oropharynx), attempted to extricate it and failed. He in turn referred her to another hospital for removal. At the second hospital an attempt was made at removal in sitting posture and it was found that the Denture had embedded itself into the tissue of Oropharynx. Thus, patient a seven month old heavy gravida mother was shunted from hospital to hospital for 2 day with a minimum sustenance of fruit juice.

Patient arrived at our hospital in a toxic, dehydrated and fatigued state. She was immediately resuscitated with plenty of intravenous fluids, intravenous antibiotics, on-call Obstetrician confirmed the well being of the unborn child, after which then a gentle examination of Oropharynx was done. We found that the denture clasp was protruding from behind the Left tonsil. We made a gentle attempt to dislodge it but it was immobile and embedded in tissue of the Vallecula. Further attempts were deferred in view of the poor general condition and distress of the patient. Situation was explained to her relatives and counselling was done. We obtained high risk consent before proceeding to immediately shift the patient to our Operation theatre.

Anaesthetist on duty examined her. He opined that these was practically no access to airway as Nasopharynx and Oropharynx both were occluded by the foreign body and there was no space even a for a Laryngeal Mask Airway insertion. He suggested that we attempt under mild sedation and immediately proceed to Emergency Trachostomy if patient warranted. The need for Emergency

Trachostomy was also explained to the relatives before starting the case.

After effective sedation of the patient we proceeded to do a Direct Laryngoscopic examination. The opposite end of the denture was found embedded in the soft tissue of Vallecula. Instead of attempting to pull the clasp forward like most of our predecessors, we rotated the denture holding the visible clasp as a fulcrum, with a heavy tonsillar artery forceps. This freed the embedded end from the tissue and we delivered the foreign body.

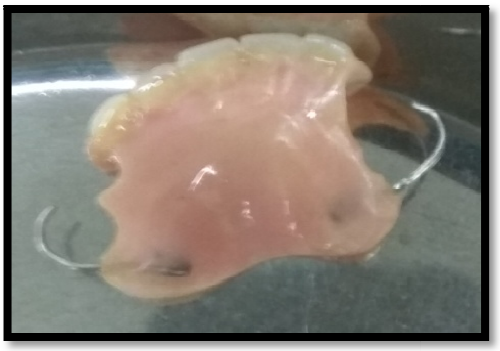

Figure 1. The Denture was impacted in vertical position with one clasp visible behind the left tonsil. Foreign body was delivered by disimpacting it from Vallecula by horizontal traction thus freeing the other clasp from being in embedded soft tissues. This was accomplished by excellent anaesthesia which reduced the patient mobility, distress and good direct visualization using a Laryngoscope.

We gave patient was a short course of Corticosteroids and watched for any airway obstruction for two days. We ascertained the health of foetus with the Obstetrician on daily basis. We discharged her after three days of rest and her Post operative period was uneventful.

Discussion:

Foreign body ingestion can happen without the knowledge of the patient especially if they are unconscious due to any reasons like alcohol intoxication. Most patients present with symptoms of Odynophagia, Dysphagia, Drooling, Stridor, Cough, Chest pain, Vomiting, Hemoptysis and Gagging. [1]

A Partial denture is a special problematic foreign body with high morbidity associated with removal. This is due to presence of sharp and curved clasp which can easily pierce and embed into the soft tissue. Any overzealous and forcible attempt at removal can lead to rupture of the hollow organ like Oesophagus with a fatal outcome. Notoriety of partial denture is added to the fact that denture may also be Radio-lucent thus invisible on an X-Ray. The only tell-tale evidence may be a column of air visible in the proximal oesophagus and widening of the Prevertebral soft tissue shadow. [2] Calcified

stylo-hyoid ligament, cervical osteophytes, long styloid process, calcification of laryngeal cartilages- Arytenoid, Thyroid, Cricoid can appear to stimulate a foreign body. [3]

Literature on good clinical practice recommends Emergent endoscopy in suspected Sharp foreign bodies and button batteries as these have high morbidity.[4] Partial denture comes in category of sharp foreign body due to presence of sharp clasps.

Tongue base and Vallecula foreign bodies account for about 15% of cases of foreign body ingestion. [5] The most likely site for lodgement of a foreign body that has been displaced from Oral cavity like a denture or a fish bone is the Crypta magna of the tonsil, followed by the epiglottic Vallecula, the Pyriform sinus and Post cricoid region. If the foreign body cannot be located by Video-endoscopy in these four key areas, it should be assumed that it has either entered Oesophagus or Right main bronchus. [6] Once a foreign body has reached the stomach, it has a high chance of passing through the intestinal tract without complication. This applies even to sharp foreign bodies like, for example pins and glass pieces. [7]

Food impaction in oesophagus is not a problem in normal adult population but common in elderly. Age related reduced peristalsis, Strictures due to chronic reflux, Eosinophilic Oesophagitis and Malignancy all may lead to food impaction. Glucagon, Effervescent drinks like Fanta, Proteolytic enzymes and Buscopan have been used to dislodge impacted bolus.[8]

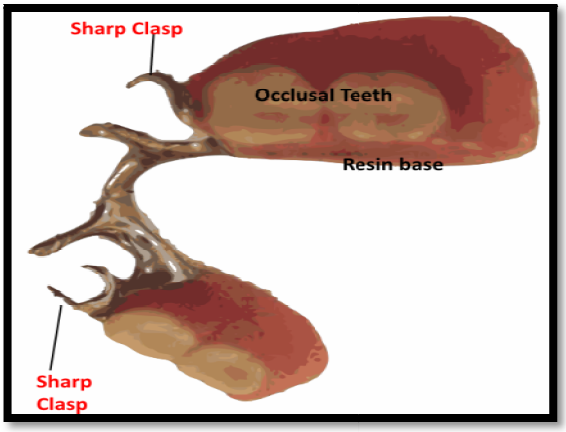

Figure 2. A Partial denture showing sharp claps which makes this foreign body notoriously difficult to manage as the clasps tend to pierce and embed into the surrounding tissues.

Partial dentures are classified using Kennedy-Applegate classification and the Partial removal denture in our case was a Class IV (Single Edentulous Area Anterior to Remaining Teeth and Crossing the Midline). The above figure shows the picture of a similar Partial denture.

The incidence of complications of this type of foreign body is directly related to the duration of impaction. Even a small foreign body can lead to a variety of complications

like Oesophageal erosion, Retropharyngeal abscess, Parapharyngeal abscess, Perforation of Oesophagus, Aorta, Pericardium and Gastrointestinal tract. Possibility of damage to adenxa must always be borne in mind. Endoscopic removal of dentures carries a high risk of perforation. [9] Minor perforations of the cervical Oesophagus produced by impalement by sharp foreign bodies like Clasp of dentures or Iatrogenic by Laryngoscopy or Oesophagoscopy or Hypopharyngoscopy can be managed by observation, nil oral intake and intravenous antibiotics. Presence of neck emphysema and retrosternal pain is strong indicator pointing towards perforation. Ryle's tube must be inserted immediately and patient admitted in Intensive care unit. [10]

Prevention is always better than cure; Dentures must be avoided if possible and must be fitted precisely. Surrounding teeth which hold the clasps must be periodically inspected for erosion. Persons with strong risk factors like frail elderly, alcohol addicts, seizure patients, pregnant mothers, chronic vertigo, drug abuse, undergoing major surgery or intubation must defer from using dentures. There is plenty of other, better and less risk alternatives to dentures like Implantable screws which may be used in such patients. [11]

Dedication:

We would like to thank our Medical Director Dr Suvarna N. Patil M.D madam for her constant encouragement.

Conflict of interest: None to declare

Source of funding: Nil

Reference

1. Webb WA. Management of foreign bodies of the upper gastrointestinal tract: update. Gastrointestinal Endoscopy 1995;41:39e50.
2. Firth AL, Moor J, Goodyear PW and Strachan DR. Dentures may be radiolucent. Emergency Medicine Journal. 2003 Nov;20(6):562-3.
3. Chawla A, Eng SP and Peh WC. Clinics in diagnostic imaging (100). Migrated pharyngeal fish bone. Singapore Medical Journal. 2004 Aug; 45(8):397-402; quiz 403. Review.
4. Uyemura MC. Foreign body ingestion in children. Am Fam Physician. 2005 Jul 15;72(2):287-91. Review. Erratum in: Am Fam Physician. 2006 Apr 15; 73(8):1332.
5. Wai Pak M, Chung Lee W, Kwok Fung H and van Hasselt CA. A prospective study of foreign-body ingestion in 311 children. Intnational Journal of Pediatric Otorhinolaryngolgy. 2001 Apr 6; 58(1):37-45.

6. El Badrawy HE. Aspiration of foreign bodies during dental procedures. J Can Dent Assoc 1985; 2:146-7.
7. Absi EG and Buckley JG. The location and tracking of swallowed dental appliances: the role of radiology. Dentomaxillofac Radiol 1995; 24:139-42.
8. Robbins MI and Shortsleeve MJ. Treatment of acute esophageal food impaction with glucagon, an effervescent agent, and water. AJR Am J Roentgenol. 1994 Feb; 162(2):325-8.
9. Nwaorgu OG, Onakoya PA, Sogebi OA, Kokong D and Dosumu OO. Esophageal impacted dentures. J Natl Med Assoc. 2004; 96(10):1350–3.
10. Morales-Angulo C1, Rodríguez Iglesias J, Mazón Gutiérrez A, Rubio Suárez A and Rama J. Diagnosis and treatment of cervical esophageal perforation in adults. Acta Otorrinolaringol Esp.1999; 50(2):142–6.
11. Lau G, Kulkarni V, Roberts GK and Brock-Utne J (2009) "Where are my teeth?" A case of unnoticed ingestion of a dislodged fixed partial denture. Anesth Analg 2009; 109: 836-838.

Effect of Topical Nasal Decongestants on Nasal Peak Flow Rates in Adults Suffering from Acute Sinusitis

Santhosh Kumar Rajamani[1]

ABSTRACT

Introduction:

In this research we studied the effect of topical nasal decongestant (Xylometazoline 0.1% solution) on serial measurements of nasal peak flow rates in a cohort of patients who were suffering from acute sinusitis.

Materials and Methods:

A population of 90 patients were chosen from our regular out-patient clinics who were suffering from acute sinusitis based on a clinical diagnostic criterion. A baseline Nasal Peak Flowmetry was done. This was followed by a common decongestant (Xylometazoline 0.1% solution) spray application. Subsequently Nasal Peak Flowmetry was done after 10, 25, 60, 120, 240 and 360 minutes and the readings were plotted and analysed.

Result:

From the AUC Curves it can be inferred that maximum decongestant action of Xylometazoline 0.1% solution is seen 1 hour after application and the rise in decongestion reaches a plateau by 2 hours. Readings almost return to baseline a good 6 hours post decongestion.

Conclusion:

Patients who are prescribed Xylometazoline 0.1% solution are advised that maximum relief from congestion would be obtained around 1 to 2 hours after application. In addition, Surgeons who use Xylometazoline 0.1% solution for nasal packing must proceed with the surgery within 1 hour of application of the pack to obtain maximum haemostatic and decongestant benefit of this drug.

Keywords:

Sinusitis; Nasal Obstruction; Nasal Decongestants; Xylometazoline

Nasal disease is a significant contributor to the suffering of millions daily. Significant nasal obstruction due to deviated nasal septum contributes to an entire gamut of nasal diseases like sinusitis.[1]

Expiratory Peak Flowmetry is a widely used test for quantification of airway obstruction in Asthma. Nasal Peak Flowmetry is a rapid test in diagnosis of functional impairment of nose in various disease conditions. This test has been applied in diagnosis and follow-up of Allergic Rhinitis.[1] In this original research we used this novel investigative tool for diagnosis as Nasal Peak Flowmetry is a non-invasive, inexpensive, rapid and accurate test in diagnosis of nasal obstruction and impaired air-flow in the nose. NPF is a simple tool for objective assessment of Nasal patency.[2] Maximum air flow is measured while blowing out of the nose or Expiration called as Nasal Peak Expiratory Flow (NPEF) and while deep breathing air into the nose or Inspiration called as Nasal Peak Inspiratory Flow (NPIF). Nasal Peak Inspiratory Flow (NPIF)is more accurate than Nasal Peak Expiratory Flow (NPEF)[2]. NPIF is more rapidly done, has a better validation and higher quantification.[3]

The disadvantages of this investigation are: (a) the presence of secretions and mucus can obstruct and reduce the peak air flow, (b) the test is less sensitive than Rhinomanometry or Acoustic rhinometry[2] and (c) the mask has to be sterilized after each use.[3]

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Materials and Methods

This was a cross-sectional descriptive epidemiological type of study. Research was done in a hospital Otorhinolaryngology clinic, and cases were analysed from cohort of patients presenting to the author with a variety of nasal complaints.

A population of 90 patients were chosen from our regular out-patient Otorhinolaryngology clinics who were suffering from acute sinusitis. 120 age matched healthy adult volunteers were also chosen as controls. Children below the age of 14 years and elderly above 70 years of age were excluded from the study. Patients who were toxic and sick were excluded. Verbal and written consent was obtained before and after measuring Nasal Peak flow rates. Nasal Peak Inspiratory Flow Rate was measured before and after packing/ spraying nose with Decongestant.[4]

Diagnostic Inclusion Criteria for Sinusitis:[5]

- Duration of complaints less than 4 weeks
- Fever, cough, fatigue, reduced sense of smell, purulent nasal discharge
- Maxillary dental pain, Ear fullness/pressure
- History of upper respiratory tract infection (common cold) in the preceding10 days
- Diagnostic nasal endoscopy shows purulence in the nasal cavity or posterior pharynx
- Computed tomography (CT) - Sinus mucosal thickening more than 5 mm, Obstruction of osteo-meatal complex (OMC)

Nasal Peak Flowmetry was done using Mini-Wright Peak Nasal Flowmeter device and patients were asked to put maximum effort inspiration and expiration.[5]

Patients were excluded from the study if they had a history of asthma or cardiac arrhythmias, or if they were taking any medications that could interfere with the PNF readings. I also excluded patients more than 70 years or below14 years.

Xylometazoline acts on alpha-adrenergic receptors in the nasal mucosa and nasal vasculature to produce vasoconstriction, resulting in reduced blood flow and reduced nasal congestion, thus producing relief from nasal obstruction in sinusitis.[7] In addition, it reduces the mucosal congestion of sinuses helping in drainage of the sinus.[8] All beneficial effects are limited by "tachyphylaxis" (Tachyphylaxis refers to the phenomenon of rebound congestion with swelling of nasal mucosa due to rapid desensitization of receptors), hence use must be limited to less than 5 days.[8]

Procedure for the Peak Nasal Flow readings

Written and verbal consent was obtained prior to the study. Patients were explained that PNF measures how fast a person can breathe through his nose, and this will give information regarding how much of the nose is choked up. Three readings were taken and highest of the three was taken as the data for study.

Mouth piece was cleaned with disinfectant solution (Savlon) and indicator reset to zero.

Patients were asked to breath out of the nose (Peak Nasal Expiratory Flow) or breath in (Peak Nasal Inspiratory Flow) with mouth closed as deep as they could. If they coughed or sneezed during the process, they needed to redo the test.

Statistical analysis

Student's two-sample "t" test was used to compare mean PNIF/ PNEF before and after decongestant use in same patient. The tests comprised the comparisons of the ratio of mean regression and mean residual sums of squares to an F distribution with appropriate degrees of freedom. We used a cut-off of 5 % level as the critical level (meaning 95% confidence in analysis) of significance in our bio-statistical tests. Maximum value or C_{max} and Area under curve were determined for analysis. This was followed by Kaplan-Meier analysis using Bio-statistical graphing software PAST and log-rank test and Cox proportion hazard test and p values were calculated.

Result

A total of 90 patients met the clinical profile of acute sinusitis and were administered the Peak flowmetry test before and after application of Xylometazoline Nasal spray. (Table I)

A baseline Nasal peak Flowmetry was done and this was followed by nasal decongestant (Xylometazoline 0.1% solution) spray application, followed by serial

Table I: Clinical characteristics of acute sinusitis patients included in this study. (N = 90)

SL. NO	CLINICAL VARIABLE	DATA
1.	Mean age (range)	27.8 (15-69)
2.	Sex	Males 48.9% and females 51.1%
3.	Height of patient (centimetres)	160.12 (centimetres)
4.	Smokers	15.56%
5.	Cough	62.22%
6.	Facial pain	44.44%
7.	History of Upper Respiratory tract infection (Common cold) previously within 10 days	73.33%
8.	Diagnostic endoscopy confirmed	100%

readings of Nasal peak Flowmetry done after 10, 25, 60, 120, 240 and 360 minutes. Serial time-bound measurement of increase in Nasal peak Flowmetry (mean values) values was done before and after nasal (decongestion) treatment with topical Xylometazoline 0.1% solution.[10]

It can be inferred from the PNIF/PNEF data that nasal airway increases with time after decongestant application. This is bio-statistically described as classical "Peaked-In" behaviour of a time dependent variable. In our study the flow rates start from a baseline within 10 minutes from application, rise to a peak by an hour, plateau by 2 hours and then slowly return to baseline by 6 hours. (Fig. 1) Maximum value or C_{max} of Peak Nasal Inspiratory Flow rate obtained at 1 hour is 170.4 L/min in males and 157.8 L/min in females. Area under the curve (AUC) is calculated asunder, using the standard mathematical formula (Trapezium area formula).[11] (Table II)

Kaplan-Meier Bio-statistical Analysis was done in order to establish and authenticate the time based criteria that are set out by this research. Peak nasal decongestion was taken as survival or 1 for event meaning maximum decongestion achieved 0 for failure or censored. The time for the event was taken on x-axis and probability on y-axis. Plots of Kaplan-Meier curve were generated using PAST (Paleontological statistics software package for education and data analysis).[9] This was followed by log-rank test and Cox proportion hazard test and p values were calculated from the table data. (Fig. 2)

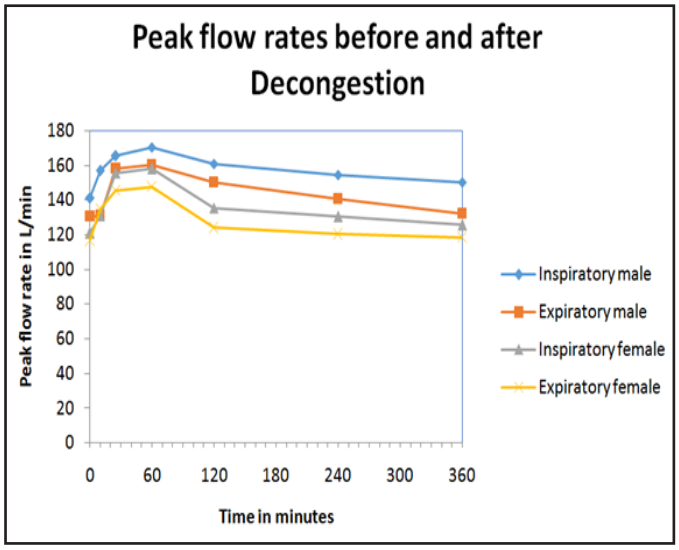

Fig. 1. Plot of Various Mean Peak Flowmetry readings in Acute Sinusitis patients

Table II: AUC Values for various Curves plotted for Inspiration/ Expiration in male and female

VARIABLE	INSPIRATORY MALE	EXPIRATORY MALE	INSPIRATORY FEMALE	EXPIRATORY FEMALE
Area Under Curve (AUC) Unequal Time Interval study	56889.43	52162.8	48968.2	45560.33

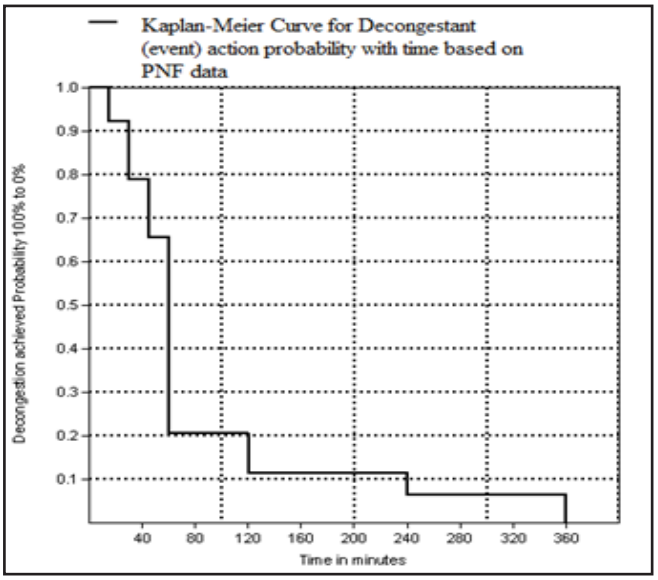

Fig. 2. Kaplan-Meier curve for maximum decongestant action of Xylometazoline 0.1% solution spray application (event) plotted against time based on Peak nasal flow rate data

Average time to decongest the mucosa was found to be 74.5 minutes (1 hour 24 minutes). The log-rank test for the data in our research was P = 0.0080; thus the two curves are statistically significantly different. Cox proportion hazard test,[11] which gives a relative event rate in the groups showed that, Sex and Peak nasal flow rates are strongly correlated except in PEFR of female where their Female sex has not made any statistical difference. (Table III)

Discussion

Xylometazoline is the work-horse decongestant of Rhinology practice. It is extensively used in management of sinusitis and in peri-operative period by most surgeons. Many prefer to use Xylometazoline with Lignocaine to pack nasal cavity before undertaking nasal surgery. Some advocate its use, up to 5 days before and even after Nasal procedures. Duration of action of nasal decongestant is traditionally thought to be up to 10 hours.[3]

This is the first study in an attempt to quantify the decongestant action of Xylometazoline by using Peak Nasal flow-rate as a tool to measure Nasal airway. This study is rather an objective one with patient providing PNF data without subjective relief being measured.

From the AUC curves it can be inferred that maximum decongestant action of Xylometazoline 0.1% solution is seen 1 hour after application with a mean time to achieve maximum decongestion being 74.5 minutes (1 hour 24 minutes) and the rise in decongestion reaches a plateau by 2 hours. Readings almost return to the baseline at around 6 hours post decongestion.

This fact is clinically reported by patients who frequently claim relief from nasal congestion immediately following use of the spray after which the effect seems to reduce in few hours. Though 8 to 10 hours is mentioned in literature[3] as average duration of action of Xylometazoline 0.1% solution, practically the effect does not seem to last more than a couple of hours which can be attested by this research.

Conclusion

Decongestant action of Xylometazoline 0.1% solution as quantified by Nasal peak Flowmetry begins within 10 minutes of application and the maximum rise of curve is seen 1 hour (Mean time of 1 hour 24 minutes) after application. Most patients also report relief around 1 to 2 hours after use of the spray.

After 1 hour the effect tapers off to a plateau by 2 hours and 6 hours post application the Nasal peak flow rates almost reach the baseline values.

Table III: Cox proportion hazard test for Inspiration/ Expiration in male and female

TEST STATISTIC	INSPIRATORY MALE	EXPIRATORY MALE	INSPIRATORY FEMALE	EXPIRATORY FEMALE
Cox proportion hazard test	Hazard ratio	Hazard ratio	Hazard ratio	Hazard ratio
	0.58	0.61	1.44	1.71
	p-value	p-value	p-value	p-value
	0.0067	0.004	0.0032	0.321
	significant	significant	significant	Not significant

Clinical Application

Patients who are prescribed Xylometazoline 0.1% solution are advised that maximum relief would be obtained around 1 to 2 hours after application and thereafter the effect would decrease.

Surgeons who use Xylometazoline 0.1% solution for nasal packing must proceed with the surgery within 1 hour of application of the pack to obtain maximum haemostatic and decongestant benefit of this drug. Reasonable expected duration of maximum benefit of decongestion from Xylometazoline 0.1% solution is around an hour to two hours.

References

1. Corey JP, Houser SM, Ng BA. Nasal congestion: a review of its aetiology, evaluation and treatment. Ear Nose Throat J. 2000; 79: 690-3
2. Holmstrom M. The use of objective measures in selecting patients for septal surgery. Rhinology. 2010; 48: 387-93
3. Clarke RW, Jones AS. The limitations of peak nasal flow measurement. Clinical Otolaryngology Allied Sci. 1994; 19: 502-4
4. PDR Physicians' desk reference for non prescription drugs. 19th ed. 1998. Montvale, NJ: Medical Economics Co Inc; 1998. p. 704
5. Pearlman A, Conley D. Review of current guidelines related to the diagnosis and treatment of Rhinosinusitis. Current Opinion in Otolaryngology Head and Neck Surgery 2008; 16:226-30
6. Bende M, fukami M, Arfors KE, Mark J et al. Effect of oxymetazoline nose drops on acute sinusitis in the rabbit. Annals of Otorhinolaryngology 1996;105:222-5
7. Gillis MC Ed. CPS Compendium of pharmaceuticals and specialties. 34th ed. Ottawa: Canadian Pharmacists Association; 1999. p. 469
8. Lacy CF, Armstrong LL, Ingrim NB, et al. Eds. A Drug information handbook. 6th ed. Cleveland: Lexi-Corp Inc; 1998. p. 764
9. Hammer, Ø., Harper, D.A.T., Ryan, P.D. PAST: Paleontological statistics software package for education and data analysis. Palaeontologia Electronica 2001; 4(1): 9
10. Ottaviano G, Scadding GK, Scarpa B, Accordi D et al. Unilateral peak nasal inspiratory flow, normal values in adult population. Rhinology. 2012; 50: 386-92
11. Guyatt G, Rennie D. User's Guide to Medical Literature: Essentials of Evidence Based Clinical Practice. Chicago, IL: American Medical Association; 2002.

Original Research Article

Tympanometric screening for Otitis media of paediatric patients with respiratory tract infection in rural setting a prospective observational study

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Abstract

Introduction: Early identification of hearing impairment in childhood is imperative, as even a mild hearing loss can have long term consequence on the development of the Central Nervous System. Many children develop transient, fluctuant deafness due to Middle ear effusion, especially during episodes of Common cold. In this research we try to develop a Screening protocol using Impedance Audiometry for early identification of Middle ear effusions. **Materials and Methods:** Children between 7 months to 6 years of ages, with no previous history of hearing impairment or ear disease, who were suffering from Upper respiratory tract infection (Common cold) were selected as targets of screening. These children were then subjected to a Screening Tympanometry. A simple, quick and accurate method of screening for Middle ear fluid was "**Peak**" or "**No peak**" approach was employed to judge the curves. If a curve was obtained (similar to Jerger's classification-type "A") child was deemed to have "Pass". A type "B" curve was deemed highly positive and was labelled "**Fail+**" and any other trace like type "C" or just reduced type "A" or "As" labelled just "**Fail**". Otoscopic and endoscopic examination and diligent search was carried out for signs of Middle ear effusion and confirmation was done. This was cross checked by 2 authors (First and third author) and findings confirmed. **Results:** Dervan child screening protocol is 91.67% (92%) sensitive and 94.23 (94%) specific is detection of Middle ear effusions. **Conclusion:** Dervan child Middle ear effusion protocol can be used in a cost efficient, scalable and sustainable method of screening children for Middle ear effusion. Tympanometry in selected high risk population is an accurate and reliable test for detection of Middle ear effusion

Keywords: Middle Ear Effusion, Serous Otitis Media, Secretory Otitis Media, Impedance Audiometry, Tympanometry, Electroacoustic Impedance Tests, Acoustic Impedance Tests

Introduction

Early Identification of Middle Ear Disease in Children is important because Hearing impairment even mild to moderate levels can lead to irreversible consequence on the development of the Nervous system. Despite large scale use of Otoacoustic Emissions for screening of Newborns and Infants, most children will develop transient Hearing impairment which is present only during episodes of common cold (Upper Respiratory Tract Infection URTI). Many children who develop episodic Middle ear effusion will suffer from variety of fluctuant deafness for weeks and months, which can impact the development of the Nervous system [1].

Materials and Methods

Tympanometric Screening is a strategy to detect Children who have a middle ear effusion from those who do not in a pain-free, safe, scalable, quick, and cost-effective manner. The main objective of this Tympanometric screening is to

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minimize the consequences of hearing impairment or chronic middle ear disease as early as possible so that the disorder will not interfere with the Neuro-development of the child and hence lead to a disabling condition. In 1977, a special task force constituted by the American Speech-Language-Hearing Association (referred to as the ASHA) studied the use of Impedance measures in screening for middle ear disease and concluded that there was a value of Tympanometric screening. The task force recommended screening of special higher risk groups of children, namely Native American children, those with sensorineural hearing loss, children with development delay and children with Down's syndrome, cleft palate and other craniofacial anomalies [2].

The percentage of cases correctly diagnosed by the test is called its **Sensitivity**, and the percentage of negative results from the tests in normal subjects is called the **Specificity** of the test. This ASHA method of Impedance screening suffers from low specificity, where in a large number of normal children also get referred for further evaluation [3].

Historical Tympanometric screening programs

ASHA guideline (1997) for screening children from 7 months of age to 6 years uses the following criterion [4]

Table-1: ASHA guideline (1997) for screening children from 7 months of age to 6 years.

Serial	
1	Case history
2	Examination of Ear namely Ear canal and Tympanic membrane
3	Impedance Audiogram with 220 or 226 Hz Probe tone

Hirtshal program for Tympanometric screening of children uses only tympanometry and no acoustic reflex measurement. A normal tympanogram (type "A") is considered pass. The remaining children receive a second measurement in 4 to 6 weeks to allow resolution of effusion and all cases with flat (type "B") tympanograms are referred. Children still remaining from second testing receive a third test 4 to 6 weeks later. Children with normal Type "A" tympanograms or tympanograms having peaks in the range of 100 to 200 da Pa are excluded. Those having flat (Type "B") tympanograms or tympanograms with peaks below 200 daPa at the third test are referred (8 to 12 weeks after initial testing). Hirtshal screening protocol has, sensitivity of 80% and specificity of 95% and a referral rate of8 to 10% only [5].

Type of Study, sampling and ethical considerations- This was a unicentric, hospital based setting, cross-sectional, epidemiological, population based research and the accepted level of significance p value of 0.05 (95% significance). The sampling was random paediatric patients who attended the clinic for symptoms of upper respiratory tract infection. Data was collected by the first author with cross verification done by the other authors.

There were no ethical issues involved as the test was conducted free of cost for the patients and Tympanometry is non invasive, rapid, painless and objective. Staging system of Pars tensa retraction suggested by Sade was used to clinically grade the degree of retraction. Neither treatment nor surgical intervention was included in this study.

Development of our Screening protocol– Dervan child hearing screening protocol [4]

Inclusion and exclusion criteria

In neonates the standard 226-Hz tympanograms donot provide correct diagnostic information due to immaturity of the Ossicles, horizontal orientation of the Tympanic membranes [6]. In addition the Tympanogram of Neonates is claimed to be of a notched "M" shape [7]. Neonates were thus excluded from the study.

For selection of the screening the following inclusion criteria were used.

1. Children between 7 months to 6 years of ages.

2. Any hearing loss beyond 55db was deemed not due to Serous Otitis media and was excluded from this protocol. Children with any evidence ear discharge were excluded from the study as these would be cases of Chronic Otitis Media (COM / CSOM) not a subject of this current research.

3. Those children suffering from Upper respiratory tract infection, Common cold, with a running nose, low grade fever, minimal cough and fatigue. Children generally develop Middle ear effusion only under the conditions of an upper respiratory tract infection or common cold. Most of these effusions go undetected and under diagnosed.

4. External ear canal was examined under light to rule out Cerumen or Ear canal atresia or any other ear canal pathology which could lead to erroneous interpretation of our Tympanometric findings. Smaller ear canals and horizontal placement of Tympanic membranes, lack of cooperation, and operator variability of findings (subjectivity) are few problems associated with Otoscopic examination. Note Otoscopic examination of ear drum was not done as the first step as the protocol was for screening purpose.

Peak or No peak Impedance Audiogram- Tympanometry equipment was calibrated on daily basis. Mother was told to hold the child on her lap while an Impedance audiogram was recorded with a hand held probe. A simple, quick and accurate method of screening for Middle ear fluid was "**Peak**" or "**No peak**" approach. Here the screening test was deemed "**Pass**" if a peak was found in the Impedance graph while test was deemed "fail" if no peak was observed.

A type "B" trace was deemed highly positive and labelled as "**Fail+**" and any other trace like type "C" or just reduced type "A" or "As" was labelled as "**Fail**" [8].Multi-component tympanometry (MFT) tympanometry and non standard frequencies (other than standard 226-Hz) were not used as these are more experimental and hence not standardized [9].

Otoscopic examination and scoring system of Middle ear retraction- This was carried out for all children who "failed" the "Peak or No peak" test. Diligent examination of the Tympanic membrane was done to look for presence of fluid or retraction. The following staging system of Pars tensa retraction suggested by Sade was used [10].

Stage I- retraction of tympanic membrane due to negative pressure in the middle ear. Anterior and posterior malleal folds are prominent and there is distortion of light reflex. Long process of incus is not visible

Stage II- retraction of tympanic membrane which is reaching the long process of Incus

Stage III- Middle ear atelectasis/collapse: Tympanic membrane touching the promontory and the ossicles but not adherent to these structures. The middle ear remains relatively intact.

The tympanic membrane is mobile though is restricted.

Stage IV- adhesive otitis media: Middle ear space is obliterated. Tympanic membrane is adherent to ossicles and promontory. No movements can be elicited.

This was marked as **Sade 1, 2, 3, 4** on the case papers in red ink.

Pure tone Audiogram- This was carried out in a selected group of children whose ear was found pathological on Otoscopic screening. This was possible only if the child was cooperative, which was occasionally possible after conditioning.

The whole screening process takes under 50 seconds of time per child. Most patients who "pass" the screening impedance do not need any further evaluation. Those with "fail" and "fail+" were further evaluated.

Follow up screening was done after 4 to 6 weeks to allow spontaneous resolution of effusion. If the child still "Failed" the screening, this was taken up for necessary medical or surgical intervention.

Biostatistical analysis- Bio-statistical analysis was done using the Open source P.A.S.T Statistical software package [11]. A Confidence interval of 95% (p=0.05) was setup for the entire hypothesis tested in this study.

Analysis of variance test (ANOVA), Pearson's Chi-square test and linear regression modelling were done to compare the observed traits. Homogeneity of demographic and clinical data was thus ascertained. A nonparametric test to compare two samples such as the Mann-Whitney was used when Normality of our data was questionable [12].

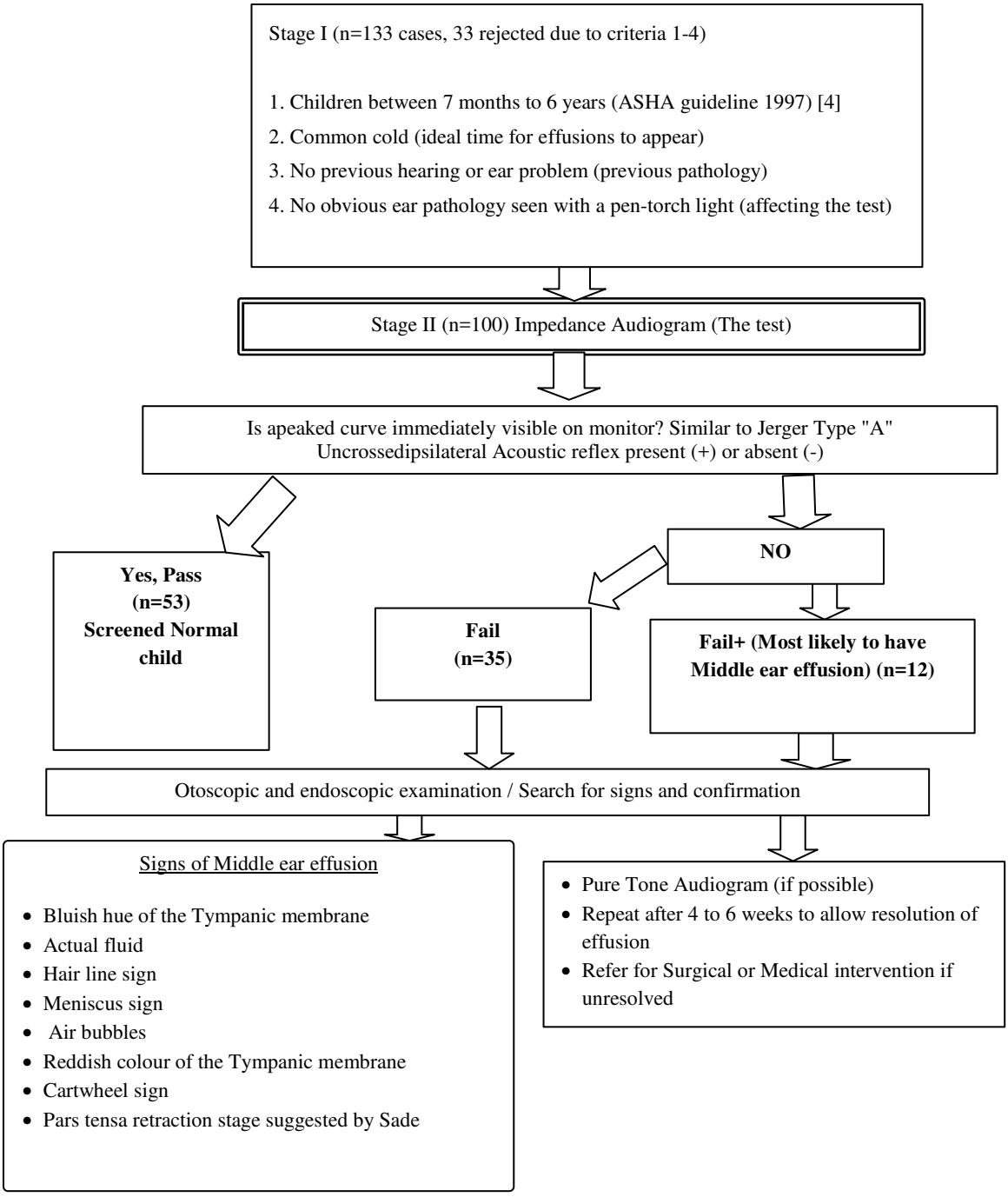

Fig-1: Dervan child screening protocol for detection of Middle ear effusion and transient deafness

Result

Table I depicts demographic characteristics of participants in this Screening protocol. Children of from 7 months of age to 6 years, who attended the Paediatric medical clinic, for symptoms of common cold (which is the ideal time for effusions to manifest), having normal hearing child (No previous ear pathology) and no obvious ear canal pathology observed with a common pen-torch light (affecting the test) were inducted into the first stage of Screening.

A total 133 children were examined at Paediatric clinic, 33 were rejected in stage 1 and100 children were included for the study stage 2

The average age was 4.5 years (Standard deviation of 0.8 years), and the majority of suffering patients were female (68%). There were no observed statistically significant differences in age, sex across disease types.

Table-2: Baseline demographic characteristics of children who were screened.

Screening participants demographics	
Characteristic	No. (%)
Female sex	73% (73 females + 27 males)
Mean (SD) age (y)	4.5 +/- 0.8 years
Age (y)	
7 months- 1 year	12 (12%)
1-2	16 (16%)
2-3	20 (20%)
3-4	11 (11%)
4-5	15 (15%)
5-6	12 (12%)
6-7	14 (14%)
Symptoms	
Cough	56 (56%)
Common cold, Running nose, fever	100(100%)
Ear block, Ear pain, holding the ear	54 (54%)
Other co-morbidities, infections	
Malnutrition (Skin fold thickness)	34 (34%)
Acute tonsillitis	27 (27%)
Cleft palate	2 (2%)

Table-3: Basic Tympanometric data of children who were screened.

Tympanometric parameter	Mean quantitative values which were observed	Range +/- 2SD (SE)
Ear canal Volume	0.876 ml	0.42 ml
Compliance	0.31 ml	0.27 ml
Pressure	17 daPa	11 daPa
Gradient	161 daPa	40 daPa

A total of 133 cases were chosen, from which 33 were rejected by the paediatrician on the basis of inclusion criteria. These were as follows: 1. Children between 7 months to 6 years (ASHA guideline 1997), 2. Suffering from cold which is ideal time for effusions appear, 3. No previous hearing or ear problem and 4. No obvious ear pathology seen with a pen-torch. Hundred children were included in this screening program, amongst which 55 children had an immediately visible peakon Impedance audiometer (Jerger Type "A"). These children were deemed “Pass” in the screening.

Those who did not have a visible reading on Tympanometry were deemed failed in the screening and were most likely suffering from permanent or transient middle ear pathology.A type “B” trace was deemed highly positive and labelled as “**Fail+**” and any other trace like type “C” or just reduced type “A” or “As” was labelled as “**Fail**”. “Fail” category those with a “Fail” were examined with Otoscope and diagnostic endoscope.

Diligent search was done for signs of Middle ear effusion (illustrated in the chart) like meniscus sign, hair line sign and air bubbles in middle ear. Any positive finding was confirmed by a consensus between two surgeons (Principal author and Co-author). Thus Screening Impedance audiogram was compared with a gold standard test of direct visualization of the Middle ear effusion.

Discussion

Aetiology and patho-physiology of paediatric middle ear diseases and conductive deafness- There is a phase differential between sound waves travelling in the air column and fluid filled cochlea which is site of perception of sounds [13]. This phase differential is overcome by the transformer action of the middle ear, tympanic membrane and ossicles [14]. Thus acting as an amplifier of sound and transmit it to the inner-ear fluid. If this conduction pathway is obstructed sound can still travel via the skin and through the bones of the skull and directly stimulate the cochlea [15]. This occurs at the cost of significant energy loss. The most common causes of conductive hearing loss include impacted wax in the external canal, otitis media, which can be infected fluid (chronic Suppurative otitis media C.S.O.M) or transudation fluid (serous otitis media S.O.M/ middle ear effusion) accumulating in the middle ear [16]. With long standing cases chronic otitis media there is a risk of development of a cholesteatoma, which is skin lined, sac like structure. Cholesteatoma is notorious for erosion and destruction of the bone eventually leading to major complications like brain abscess and meningitis [17].The vast majority of cases of Otitis media have a benign clinical course, Otitis Media can lead totransient and permanent deafness, developmental delays or serious extra-cranial or intracranial complications likebrain abscess and meningitis [18].

Middle ear infections leading to delayed speech and language development, academic performance in schools, psychological development, neurological “soft signs” and cognitive ability has been studied extensively in western population and many papers published at the crux of the pathology [19]. But no such research exists for the Indian especially Konkan children. As such due to difference in demographics of the people it is expected that patter n of presentation of Otits media would be different and more subtle as compared to their western cohorts.

The most common type of acquired hearing loss is conductive hearing loss due chronic middle ear effusion also known as Secretory Otitis media. The age distribution in children described in literature is bi-modal with first peak at around 2.5 years of age, then again at around 4.5 years of age when children enter the school. By one estimate about 30% of preschool children are affected in winter season [20]. The American Academy of Paediatrics estimates an incidence of over 5 million middle ear infections in American children, leading to about 30 million visits to clinics per year. Over 10 million annual antibiotic prescriptions are handed out for treatment of Otitis media. This is disease burden of middle ear effusion [21].

Acoustic Reflex Testing- Acoustic reflex detects the increase in the impedance of the middle ear in response to contraction of the Stapedius muscle within 10 ms, brought about in response to a loud sound of more than usually 80 dB or higher [22]. The afferent limb of this reflex is the Cochlea and Vestibulo-cochlear nerve, the reflex centre is located in the brain stem and efferent limb is via the facial nerve. The vertical segment of facial nerve supplies the Stapedius muscle; the nerve to Stapedius branch is proximal to the geniculate ganglion of Facial nerve. Same ear and opposite ear can be stimulated with sound and impedance increase recorded this is called uncrossed (ipsilateral) acousticreflex andcrossed (contralateral) acousticreflex test respectively [23].

This reflex becomes absent in presence of slightest degree of hearing loss, hence by itself is a sensitive test for detection of deafness**.** Same sided or uncrossed (ipsilateral) acoustic reflex test is easy to perform and can be done by the same probe which is used to record Tympanometry. This test was done and reflex was studied. If Stapedius muscle contraction within a time span of 10 ms was elicited this test was designated as “pass” and formed another criteria for screening for Conductive hearing loss and middle ear disease [24].

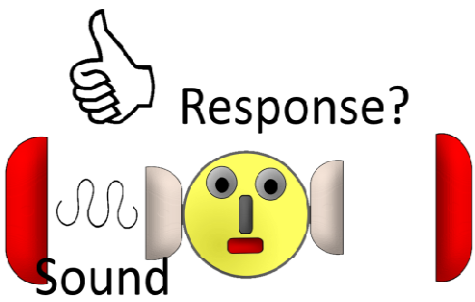

Fig-2: Uncrossed (ipsilateral) Acoustic Reflex Testing (drawn by first author) [24]

Jerger's classification for Tympanometric configurations [25]- A type "A" tympanogram is normal middle function and conveys ease of 226 Hz energy flow across the middle ear when the ear canal pressure is at zero pressure (0 daPa), with reduced energy flow if pressure is increased or decreased. This creates the classical triangular shape of a Type "A" Impedance audiogram. This indicates optimal healthy middle ear function [26].

A type "B" tympanogram suggests that there is little movement of the middle ear with pressure variation, which can be due to Otitis media with effusion, tympanic membrane atelectasis, or a tympanic membrane perforation. A type "C" tympanogram indicates that the middle ear is under negative pressure, shifting the whole curve to right [27].

Utility of this Dervan Middle ear effusion Screening (test) protocol- The quality of a test or a protocol is dependent on the following Biostatistical parameters namely validity, reliability, sensitivity, specificity and predictive values of positive/ negative tests. The validity of a screening test must be upheld by comparison with a "**Gold standard**" test which in our study is direct observation of the Middle ear effusion by two independent surgeons.

Since the test subjects were selected at random from children who attended the paediatric clinic there is no reason to assume external validity of the protocol especially on Konkan population for which this was developed. Reproducibility or reliability is open to further studies at our department or other hospitals which will validate this parameter.

The sensitivity of a protocol is its ability to accurately screen population who do have trait. The sensitivity of a protocol is its ability to accurately screen out or eliminate population who do not have trait or disease risk [28].

Table-4: Evaluation of the sensitivity and specificity of the Protocol against "Gold standard" Endoscopy/ Otoscopic examination of the ear

	Dervan child Middle ear effusion protocol	
Tympanometry	Endoscopic defined effusion	
	Yes	No
Positive test (47)	44	3
Negative test (53)	4	49
Total (n=100)	48	52

Dervan child Middle ear effusion protocol is 91.67% (92%) sensitive and 94.23 (94%) specific is detection of Middle ear effusion. The Positive predictive value of the test is 93.6 (94%) and negative predictive value stands at 92.4 (92%). Chi-square value, first degree of freedom, at Confidence interval of 95% (p=0.05) is found to be 73.93 (64.139) at p=0.05 is statistically significant. Fischer's exact test has a value of 2.9E-17, Crammer's V value of the test is V=0.84419 which are also very significant.

Contributions by three authors- The senior author and the third author were involved in the supervised audiological testing, collection of data and statistical analysis of the data. The second author being the Paediatric specialist provided technical insights into the clinical framework of the research. First author wrote the manuscript which was discussed and agreed upon by the other authors.

Conclusion

Middle ear infections leading to delayed speech and language development, academic performance in schools, psychological development, neurological "soft signs" and cognitive ability has been studied extensively in western population and many papers published at the crux of the pathology But no such research exists for the Indian especially Konkan children. As such due to difference in demographics of the people it is expected that patter n of presentation of Otits media would be different and more subtle as compared to their western cohorts. Dervan child Middle ear effusion protocol can be used in a cost efficient, scalable and sustainable method of screening children for Middle ear effusion. Tympanometry in selected high risk population is an accurate and reliable test for detection of Middle ear effusion. This reproducibility of this protocol has to be validated by further studies in our hospital and elsewhere.

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Permission from IRB: Yes

Ethical Standards: Ethical committee approval obtained dated 17/1/2018 Official Order Refer: BLKW/ RMC / IEC/26/2018(11)

References

1. Davis JM, Elfenbein J, Schum R, Bentler RA. Effects of mild and moderate hearing impairments on language, educational, and psychosocial behavior of children. J Speech Hear Disord. 1986 Feb; 51 (1):53–62. PMID: 3945060 DOI:10.1044/jshd..5101.53

2. American Speech-Language-Hearing Association. Guidelines for Audiologic Screening [Guidelines]. Available from www.asha.org/policy. DOI: 10.1044/ policy. GL1997-00199 ASHA 34:81–87, 1992.

3. Gelfand SA, Silman S. Future perspectives in hearing and aging: clinical and research needs. Semin Hear 1985; 6:207–219.

4. American Speech-Language-Hearing Association. Guidelines for screening for hearing impairments and middle ear disorders. Asha, April 1990, April 32 (Suppl. 2), 17-24.

5. Harford ER, Bess FH, Bluestone CD, Klein JO eds. Impedance Screening for Middle Ear Disease in Children. New York: Grune& Stratton, 1978.

6. Himelfarb MZ, Popelka GR, Shanon E. Tympanometry in normal neonates. J Speech Hear Res. 1979 Mar;22 (1): 179-91.

7. Paradise JL, Smith CG, Bluestone CD. Tympanometric detection of middle ear effusion in infants and young children. Pediatrics. 1976 Aug; 58 (2): 198-210.

8. Margolis RH, Heller JW. Screening tympanometry: criteria for medical referral. Audiology. 1987;26 (4):197-208.

9. Hunter LL, Margolis RH. Multi frequency Tympanometry: Current Clinical Application. Am J Audiol. 1992 Jul 1;1(3):33-43. doi: 10.1044/1059-0889. 0103.33.

10. Kasliwal N, Joshi S, Pareek SM. Determinants of sensorineural hearing loss in chronic middle-ear disease. Indian J Otolaryngol Head Neck Surg. 2004 Oct; 56(4):269-73. doi: 10.1007/BF02974385.

11. Hammer, Ø.,Harper,D.A.T., Ryan,P.D.2001. PAST: Paleontological statistics software package for education and data analysis. Palaeontologia Electronica 4 (1): 9pp. http://palaeo-electronica.org/ 2001_1/past/ issue1_01.htm.

12. Feinstein AR. Clinical epidemiology the architecture of clinical research, Philadelphia, WB Saunders. 1985;10(1):111–45.

13. Roland PS. Chronic suppurative otitis media: a clinical overview. Ear Nose Throat J. 2002 Aug; 81 (8 Suppl 1): 8-10.

14. Briggs RJ, Luxford WM. Chronic ear surgery: a historical review. Am J Otol. 1994 Jul; 15 (4): 558-67.

15. Bluestone CD, Klein JO. Otitis m edia, atelectasis, and Eustachian tube dysfunction. In: Bluestone CD, Stool SE, Kenna MA, eds. Pediatric Otolaryngology, 3rded. Philadelphia: WB Saunders, 1996.

16. Pau HW. [Eustachian tube and middle ear mechanics]. HNO. 2011 Oct;59(10):953-63. doi: 10. 1007 /s00106-011-2368-y.

17. PROCTOR B. The development of the middle ear spaces and their surgical significance. J Laryngol Otol. 1964 Jul;78:631-48.

18. Jackler RK. The surgical anatomy of cholesteatoma. Otolaryngol Clin North Am. 1989 Oct; 22 (5): 883-96.

19. Shim HJ, Park CH, Kim MG, et al. A pre- and postoperative bacteriological study of chronic suppurative otitis media. Infection. 2010 Dec;38(6): 447-52. doi: 10.1007/s15010-010-0048-6. Epub 2010 Aug 11.

20. Yeo SG, Park DC, Hong SM, et al. Bacteriology of chronic suppurative otitis media--a multicenter study. Acta Otolaryngol. 2007 Oct;127(10):1062-7. DOI:10. 1080/ 00016480601126978

21. Tos M, Poulsen G. Attic retractions following secretory otitis. Acta Otolaryngol. 1980 May-Jun; 89 (5-6): 479-86.

22. Feeney, M. P., & Sanford, C. A. Detection of the acousticstapedius reflex in infants using wideband energy reflectance and admittance. journal of the American Academy of Audiology, 2005;16(5):278-290.

23. De Chicchis, A. R., Todd N. W. & Nozza R. Developmental changes in aural acoustic admittance measurements. journal of the American Academy of Audiology, 2000;11(2), 97-102.

24. Meyer SE, Jardine CA, Deverson W. et al. Developmental changes in tympanometry: a case study. Br J Audiol. 1997 Jun;31(3):189-95.

25. Jerger J. Clinical experience with impedance audiometry. Arch Otolaryngol. 1970 Oct; 92 (4): 311-24.

26. Jerger J, Anthony L, Jerger S, et al. Studies in impedance audiometry. 3. Middle ear disorders. Arch Otolaryngol. 1974 Mar;99(3):165-71.

27. Alaerts J, Luts H, Wouters J. Evaluation of middle ear function in young children: clinical guidelines for the use of 226- and 1,000-Hz tympanometry. Otol Neurotol. 2007 Sep;28(6):727-32.

28. Antonella B, Giovanni D. C. Fundamentals of Clinical Research: Bridging Medicine, Statistics and Operations .75(3):1-3. International Statistical Review. Campbell, M. J.2007.ISSN 0306-7734. 2007. DOI:10. 1111/j. 1751-5823.2007.00030_3.x

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Original Research Paper ENT

UNDERSTANDING CAUSES OF SUB-ACUTE COUGH IN COMMUNITY – A CLINICO-PATHOLOGICAL RESEARCH

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ABSTRACT Cough is one of the most common complaints of patients seeking medical attention. A number of patients attend our OPD for complaint of Sub acute cough lasting 3-8 weeks. Majority of such cough are due to Ear, Nose and Throat pathologies. This study aims to evaluate the Otorhinolaryngology causes of Cough in these patients. Inflammation of Sinuses (Acute/Sub-acute) and Gastro-oesophageal reflux disorder (Reflux) form a bulk of cases presenting with Sub-acute cough in community. Clinicians need to maintain a high degree of suspicion for these two most common entities in cough patients not responding to conventional line of management.

KEYWORDS : Cough, Acute Cough, Chronic Cough, Sub-acute cough, GERD, Chronic pharyngitis, Allergic cough, Reflux related, Asthmatic cough, Bronchitis, Post infectious, Non Post infectiou

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.

Objectives

1. To evaluate the causative factor for sub-acute cough, cough lasting 3-8 weeks
2. To categorize the class of patient who have specific Ear, Nose and Throat pathology as a cause of cough

Materials and Methods

The present study was done in ENT Out-Patient Clinic of B.K.L Walawalkar Rural Medical College. A total of 100 patients were selected from the pool of OPD attendees, who came to our centre from 1st August 2017 to 15th January 2018.

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 fibre-optic Upper Gastro-endoscopy, 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 Sub-acute 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 paediatric 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.
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.
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 Sub-acute (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.

Table 1: Aetiologies of sub-acute cough. Multivariate analysis using Multiple regression coefficient "R" statistic MANOVA and Chi-square test using SPSS for statistical significance of data.

Cause of Sub-acute Cough	Total 100	Males % 45	Female % 55
Acute/ Sub-acute Sinusitis	34	15	19
Reflux GERD related	25	10	15
Allergic Cough / Asthmatic history	9	5	4
Upper Airway Cough Syndrome PND + Throat symptoms	6	2	4
Acute/ Chronic pharyngitis	3	2	1
Chronic laryngitis	1	0	1
Occupational cough	1	1	0
No cause identified	21	10	11

Predisposing factors identified in the clinical evaluation of the cases is illustrated in the table below.

Table2. Predisposing factors identified. MANOVA and Chi-square using SPSS

Predisposing factors for Sub-acute Cough	Total 100	Males % 45	Female % 55
Cold/ Coryza	39	20	19
Influenza/ Flu/ Viral fever	24	10	14
Spicy food intake (GERD)	44	23	21
Reflux / Regurgitation / Belching	25	9	16
Occupational exposure to allergens like farmers / industry/ construction workers (Allergic)	16	9	7
Pets / cattle at home (Allergic)	19	8	11
Smokers	15	15	0
Alcohol use	11	11	0
drug intake like ACE inhibitor, Beta blocker	12	7	5

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 Konkan, 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 Sub-acute 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 Sub-acute cough.

Discussion

Questionnaire identified patients with Sub-acute 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 odour 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 Sub-acute cough like Pneumonia and tuberculosis. Pertusis infection, Whooping cough as a cause of Sub-acute 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 Pneumo-thorax, 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 Sub-acute cough.

Conclusion

This study is a reminder to the clinician of the most common causes of Sub-acute cough in patients presenting in Otorhinolaryngology clinic. Sinusitis (Acute/Sub-acute) and Gastro-oesophageal reflux disorder (Reflux) form a bulk of cases presenting with Sub-acute cough in community. Clinicians need to maintain a high degree of suspicion for these two most common entities in cough patients not responding to conventional line of management.

REFERENCES

1. Chronic cough - diagnostic aspects Klinik und Poliklinik für Phoniatrie und Pädaudiologie, Medizinische Hochschule Hannover. Ptok.Maartin@MH-Hannover.deLaryngorhinootologie. 2008 Jul; 87(7):468-75. Epub 2007 Dec 21.
2. Otorhinolaringologic approach of the chronic cough. Clinical case Hospital General de Fuerteventura, Servicio De ORL. aliadal@terra.es An Otorrinolaringol Ibero Am. 2007;34(1):75-80
3. Proposals for a Diagnostic Algorithm for Acute and Chronic Cough: P. Kardos Pneumologie 2000; 54(3):110-115 DOI: 10.1055/s-2000-11064
4. Etiology of Cough. Pritchard JS.Can Med Assoc J. 1925 Nov;15(11):1145-7. No abstract available. PMID: 20315568 [PubMed]
5. Irwin RS, Baumann MH, Bolser Dc et al Diagnosis and management of cough executive summary: ACCP evidence based clinical practice guidelines Chest 2006; 129:1s-23S
6. Irwin RS, Madison JM the Diagnosis and treatment of cough N England Journal of Medicine 2000; 343:1715-23

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Migrainous vertigo (Migraine-associated dizziness) in adults - clinical and audiological profiles in patients suffering from chronic recurrent vertigo and headache: An original research.

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ABSTRACT

Background: Half of patients who suffer from Migraine also concurrently suffer from vertigo. Migrainous vertigo is emerging as a distinct entity related to Common migraine but having a number of distinctive clinical features. This study aims to highlight the novel clinical and audiological features of Migrainous vertigo. **Methods:** In this study 53 patients who suffer from Migrainous vertigo were analyzed. **Results:** It was found the most clinical features of Migrainous vertigo parallel Common migraine like Long history of headache typically 4.3 years, episodes lasting few hours, absence of Aura, female preponderance, sleep relief and phonophobia. **Conclusion:** Audiological features of Migrainous vertigo are a distinctive 5 to 10 dB decrease in Air-conduction curves in frequencies 2,000 to 4000Hz, during an attack of Migrainous vertigo is found in 63% of cases.

Keywords: Migraine, vertigo.

INTRODUCTION

This study aims to elucidate the clinical and audiological features of Migrainous vertigo (Migraine-associated dizziness) in Indian population.

Background

Most (50%) migraine headache patients also suffer from concurrent episodes of vertigo.[1] The most common type of vertigo encountered in clinical practice is Benign positional paroxysmal vertigo. This type of vertigo has a tumultuous onset likened to a "Paroxysm" and a benign course. This is stark contrast to Migrainous vertigo which is characterized by moderate vertigo lasting few hours, a protracted recurrent course. [4] The main similarity and highlighting diagnostic feature is the absence of any hearing impairment. This differentiates Migrainous vertigo from other causes of Chronic recurring vertigo like Meniere's disease. [2]

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Diplopia, vertigo, incoordination, ataxia, and dysarthria, are neurologic components of the migraine attack in Basilar migraine, which is again a distinct pathological entity.[2] Continuous rotatory vertigo (lasting for days to weeks), spontaneous nystagmus (with fast phase components beating toward the normal ear), and postural imbalance, typically following an upper respiratory tract infection (URTI) are features of Vestibular neuritis, (Vestibular Neuronitis) which is different, were excluded from this study.

It has been traditionally assumed that hearing impairment is absent in Migrainous vertigo, while there are no previous studies to verify this claim. Further no studies have been done to record an Audiogram during an attack of Migrainous vertigo hence the need of such a research.

Objectives of this research

In this study we try to characterize the main clinical and Audiological features of Migrainous vertigo and relevant signs and symptoms in Indian population. Such a study has not been reported in literature for Konkani (Coastal area of Central/ Central-western India) population and Audiological evaluation of this disease has not been reported in any previous studies in this sub-continent.

MATERIALS AND METHODS

A total of 53 adult patients were chosen for the study from the cohort of cases presenting in our vertigo clinic.

Type of research

This is a type of observational studies in epidemiology among cohort of cases presenting in our vertigo clinic. Study follows the guidelines broadly set out by strengthening the reporting of observational studies or STROBE consortium Reporting Guidelines. [7]

Study design

Case-control type of observational study design was used for clinical profiling of cases. In addition, audiological component of this research a cohort study with the subtype being prospective cohort or forward cohort study design. Data was obtained in a paired fashion by this cohort study. While the epidemiological data for association. All controls were other patients with headache attending our weekly clinic.

Settings of study

Study was conducted in Otorhinolaryngology clinic of a tertiary care hospital, based in a rural area and serving three adjacent districts. Participants were patients attending our headache/ speciality clinic and fulfilling the criterion that follows.

Inclusion of case

The inclusion criteria based on Lembert and Neuhauser who have defined the following criteria for diagnosis of Migraine-associated vertigo[5].

- Definite Migraine-associated vertigo[5]

1. Episodic moderate vertigo lasting few hours with imbalance and dizziness
2. Current or previous history of migraine in accordance with definition given in International Classification of Headache Disorders (ICHD-2) released in year 2004.
3. Headache or Migraine symptoms during two or more attacks of vertigo like photophobia, irritability, tinnitus
4. Other causes ruled out by investigations like X-ray Paranasal sinuses, Diagnostic nasal endoscopy, Computed tomography of Brain and Paranasal sinuses

- Probable migraine-associated vertigo[5]

1. current or previous history of migraine
2. Headache or Migraine symptoms during two or more attacks of vertigo like photophobia, irritability, tinnitus
3. Positive history of precipitating factor like female gender, dark, flashes of light, fatigue, certain foods, menstruation
4. response to migraine medications in more than half of attacks
5. Other causes ruled out by investigations

Headache per se is not needed for diagnosis of a Migrainous vertigo.[5] Slater previously coined the term “Benign recurrent vertigo” for similar set of clinical features, like female gender, recurrent episodes, similar precipitating factors and headache.[6]

Audiological evaluation during an attack of Migrainous vertigo

A routine screening of cases was done to establish any concurrent pathology like Presbyacusis in all cases included in this study. And a second audiogram was recorded during the attack of Migrainous vertigo. Out of 53 patients selected, we were able to convince 19 patients to get come get admitted during an attack of vertigo and headache, hence were able to document an Audiogram during an actual attack of vertigo.

Variable studied in this research

Epidemiological data was collected in the following headers age, sex, reported mean number of years of suffering headache, occupation, number of attacks of Migrainous vertigo per week or month, average duration of headache, presence aura, frequency of attacks of vertigo along with migraine, Visual analogue score from 0 to 5 for severity of pain and vertigo. Pure tone average threshold at normal time and second recording during an attack of Migrainous vertigo was recorded.

Biostatistical methods

Various statistical tests were carried out using GNU-PSPP Open source software package released under LGPL Licence. A confidence interval of 95% (p=0.05) was employed for hypothesis tested in this study. Analysis of variance test (ANOVA), Pearson’s Chi-square test and Linear regression modelling were employed in order to compare the Audiological data, demographic and clinical characteristics. When condition of normality of data was doubtful, we used a non-parametric test to compare two samples such as the Mann-Whitney (Non parametric data like Visual analogue score for pain and vertigo) or Wilcoxon signed-rank test (Paired non parametric data). Members of the cohort were normal patients who were tested and found free of this disease. Paired Student’s t test was used at 95% confidence interval to conclude statistical difference in before and after quantitative data like Pure tone audiometric threshold mean.

RESULTS

On an average 120 patients attend our headache clinic per week (480 per month) we screened 170

patients who were found potentially eligible for inclusion. Further evaluation led to discovery of some other cause of headache/ vertigo like sinusitis or Meniere's disease. Final tally of 53 adult patients were chosen for the study and we were able to acquire before after Pure tone audiometric findings in 19 such cases during an attack.

Demographic data

The demographic characteristics of the patients are summarized in the table shown below.

Table 1: Observed demographic and clinical characteristics of Migrainous vertigo patients attending our clinic

S. No	Variable	Data	
	Median average age of patient	23.5 years (youngest adult 14 years to eldest 57 years)	
	Sex	M 14 (26.415 %)	/ F 39 (73.585 %) p=0.0078 Statistically significant difference
	Reported mean number of years of suffering headache	4.3 years (4 years 3 months and 18 days)	
	Occupation	Farmers	21
		Fishermen	16
		Workman/ Carpenter/Black-smith	9
		No specific type of work	4
		Others	3
		Total	53
	Mean number of attacks of Migrainous vertigo per week or month,	Week	(2 to 7) 2.812 attacks per week
		Months	(5 to18) 12.033 attacks per month
	Average duration of headache in hours	3hours to 9 hours (4.61 hours)	
	Presence aura,	Aura present	14 (26.42%)
		Aura absent	39 (73.58%)
	Reported mean frequency of attacks of vertigo along with migraine	Week	(0 to 7) 0.34 attacks per week
		Months	(3 to17) 7.33 attacks per month
	VAS Visual Analogue Score from 0 to 5 for pain severity	Average 3.2	
	VAS Visual Analogue Score from 0 to 5 for vertigo severity	Average 2.1	
	Does Sleep relieve the attack of headache and vertigo?	Yes 86.79% Statistically Significant p=0.0082	No 13.21%
	Phonophobia or Hypersensitivity to loud sound during an attack	Present 67.92% Statistically Significant p=0.0029	Absent 32.08%

Audiological findings

To acquire a baseline measurement, Pure tone audiogram was done in all cases. This was followed by Pure tone audiogram during an attack of vertigo this is a unique feature of this study.

Table 2: Observed audiological features of Migrainous vertigo patients attending our clinic

S. No	Pure Tone Audiological findings	Data
1	Normal audiogram Criteria 1.Air conduction curve less than 30-35 dB 2.Air bone gap less than 20 dB 3. Normal Pure Tone Average	79.25% cases (42/53) Average P.T.A was 23.45 dB HL
	Abnormal Baseline Audiogram	
2.	Sensorineural Hearing loss	13.20% cases (7/53)
3.	Conductive Hearing loss	7.56% Cases (4/53)
4.	Audiometric findings during an attack11	5 to 10 dB Decrease in Air-conduction curves in frequencies 2,000 to 4000Hz During an attack of Migrainous vertigo 63.16% Average PTA was 32.44dB Paired t Test has p=0.023 Statistically significant difference is found during an attack.
5.	Tinnitus during attack 11	47.37% (9/19 cases) Statistically not significant p=0.98

DISCUSSION

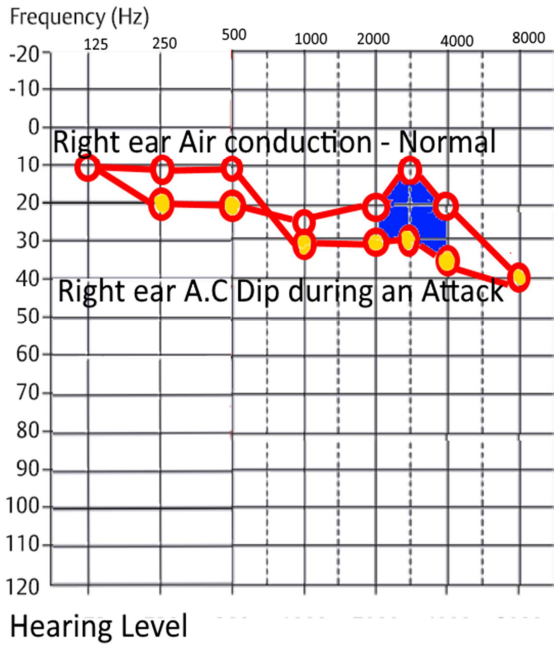

Figure 1: Pure Tone Audiogram from a typical case showing characteristic Decrease in Air-conduction curves in frequencies 2,000 to 4000Hz during an attack of Migrainous vertigo was seen in many patients

Most Inner ear diseases have a characteristic feature in Pure Tone Audiogram, for example Presbyacusis presents with a sloping High frequency hearing loss, while Meniere's disease presents with a 500 Hz tenting. This is seen in majority of cases.

Migrainous vertigo seems to a disease spread across all ages from 14 years to eldest 57 years. Similar to Common Migraine, this disease seems to be more common in females (p=0.032 statistically significant difference). This feature has been reported in literature as 3 times more common in females as males [8]. Typical patient suffers on an average 4.3 years' history of headaches and suffers from 3 attacks per week to 12 attacks per month. Duration of attacks is around 4.6 hours per attack. Aura is absent like Common migraine in 74% cases. vertigo and headache are simultaneously present in 7 attacks per month

The Pure tone audiogram features of Migrainous vertigo have not been described in literature before. The characteristic feature of Audiogram of Migrainous vertigo patient is the 5 to 10 dB decrease in Air-conduction curves in frequencies 2,000 to 4000Hz during an attack of vertigo. Phonophobia (Hypersensitivity to sounds) is a common feature during the attacks. This was found to be statistically significant. [11]

Exact pathological mechanism that leads to association between Meniere's disease and Migraine or Benign Paroxysmal Positional vertigo and Migraine is still unknown. [9] and 12]

CONCLUSION

Migrainous vertigo attack has some unique Audiological features worthy of further research. Clinical features of Migrainous vertigo are parallel to that of Common migraine. Most patients of Migrainous vertigo have a normal audiogram in between attacks.

Clinical significance of this study

The characteristic feature of Audiogram of a Migrainous vertigo patient is the 5 to 10 dB decrease in Air-conduction curves in frequencies 2,000 to 4000Hz during an acute attack. In addition, a history of Phonophobia or hypersensitivity to sounds is a strong point for diagnosis of Migrainous vertigo.

REFERENCES

1. Neuhauser, H., Leopold, M., von Brevern, M., Arnold, G., &Lempert, T. (2001). The interrelations of migraine, vertigo and migrainous vertigo. Neurology, 56, 436–441.
2. James Lance& Peter J.G Mechanism and Management of Headache, 7th Ed, Philadelphia: Elsevier;2005.p47-62
3. Lance, J. W., & Anthony, M. (1966). Some clinical aspects of migraine. Arch Neurol, 15, 356–361.
4. David R. F& Lloyd B. Minor in Menière Disease, Vestibular Neuritis, Benign ParoxysmalPositional vertigo, Superior SemicircularCanalDehiscence, and Vestibular Migraine - Ballenger's Otorhinolaryngology -17th Ed,Connecticut: BC Decker;2009 p313-331
5. Lempert T, Neuhauser H (August 2005). "Migrainous vertigo". NeurolClin. 23 (3):715–30, vi. PMID 16026673.doi:10.1016/j.ncl.2005.01.003
6. Slater, R. (1979). Benign recurrent vertigo. J NeurolNeurosurg Psychiatry, 42, 363–367.
7. STROBE [Internet].http://www.strobe-statement.org
8. Lipton RB, Bigal ME, Diamond M, et al. Migraine prevalence, disease burden,and the need for preventive therapy. Neurology 2007;68(5):343–9.
9. vonBrevern M, Radtke A, Lezius F, et al. Epidemiology of benign paroxysmalpositional vertigo: a population based study. J NeurolNeurosurg Psychiatry2007;78(7):710–5.
10. Ramadan NM. Prophylactic migraine therapy: mechanisms and evidence. CurrPain Headache Rep 2004;8(2):91–5.
11. Viirre ES, Baloh RW. Migraine as a cause of sudden hearing loss. Headache1996;36(1):24–8.
12. Celebisoy N, Gokcay F, Sirin H, et al. Migrainous vertigo: clinical, oculographicand posturographic findings. Cephalalgia 2008;28(1):72–7.

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