RADIOGRAPHIC FINDINGS OF ADENOID HYPERTROPHY AND ASSOCIATED RISK FACTORS AMONG CHILDREN ATTENDING MUHIMBILI NATIONAL HOSPITAL

Cecilia Ngatunga, MD

MMed (Radiology) Dissertation
Muhimbili University of Health and Allied Sciences
October, 2016

RADIOGRAPHIC FINDINGS OF ADENOID HYPERTROPHY AND ASSOCIATED RISK FACTORS AMONG CHILDREN ATTENDING MUHIMBILI NATIONAL HOSPITAL

By

Cecilia Ngatunga

A Dissertation Submitted In (Partial) Fulfillment of the Requirement for the Degree of Master of Medicine (Radiology) of Muhimbili University of Health and Allied Sciences

Muhimbili University of Health and Allied Sciences
October, 2016

CERTIFICATION

The undersigned certify that she has read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled **"Radiographic Findings of Adenoid Hypertrophy and Associated Risk Factors among Children Attending Muhimbili National Hospital**" in (partial) fulfillment of the requirement for the degree of Master of Medicine (Radiology) of Muhimbili University of Health and Allied Sciences

_____

Dr. Mboka Jacob

(Supervisor)

_____

Date

DECLARATION AND COPYRIGHT

I, **Cecilia Ngatunga**, declare that, this **dissertation** is my own original work and that it has not been presented and will not be presented to any other University for similar or any other degree award

Signature……. Date……

ACKNOWLEDGEMENT

First and foremost, I thank my Almighty God for being with me and guiding me through the ups and downs of this work.

I also like to thank my supervisor, Dr. Mboka Jacob, for working with me from the beginning to the end, through getting ideas to get a proposal to the point of making a good report. Her guidance has not only made this work successfully but also taught me to be better, focused and dedicated in anything I put my mind to.

My gratitude also goes to everyone in the department of Radiology at MUHAS and MNH for their participation in my dissertation. They are best at showing support and love. Without forgetting the IT department of MUHAS for their technical supports especially Mr. Lazaro. In addition to that departments of Epidemiology and Biostatistics for their trainings.

Last but not least I thank my family for their support as I try to achieve great things in life. You have tolerated me on missing family activities and sometimes just having poor communication for the sake of education.

DEDICATION

I dedicate this work to my lovely husband Dr. Benedict Ngunyale and my daughter Erica for their love and support through thick and thin.

ABSTRACT

Background

Adenoid is a mass of lymphoid tissue in the nasopharynx that produces antibodies. Adenoid hypertrophy is the most common cause of nasal airway osbruction in children. PNS, STL radiographs are used widely to diagnose adenoid hypertrophy. The aim of this research is to find common radiographic findings and associated risk factors of adenoid hypertrophy among children refered for PNS, STL radiography at Muhimbili National hospital. Less is known on radiographic patterns of adenoid hypertrophy at our setup.

Broad objective

To determine radiographic findings of adenoid hypertrophy and associated risk factors among children attending Muhimbili National Hospital.

Methodology

This was a descriptive cross sectional study which was conducted at Radiology department, Muhimbili National Hospital from June to December 2015. Children referred for PNS, STL radiography for assessment of nasopharynx were included in the research. Consenting patients were consecutively included in the research. Structured questionnaires were used for recording patients' demographics, clinical information and imaging findings obtained from PNS, STL radiographs. Data analysis was done using the Statistical Package for Social Sciences (SPSS) version 20. Statistical associations were done by using cross tabulations and Chi-square test was used to compare proportions. P value of < 0.05 was considered statistically significant.

Results

The research included 114 children who where refered to the Radiology department due to features suggestive of nasal obstruction. Moderate degree of obstruction on radiography was present in majority of cases. Most of the patients were in 1-3 years old age group (57.9%). The median age was 3 years. Males were 57% and females are 43%(1.3:1). The highest mean nasopharyngeal depth was 36.63mm in the age group 10 to 12 years and the lowest mean is in the youngest age group which is 25.95. The research showed significant

correlation between presenting symptoms and degree of obstruction assessed by adenoid to nasopharyngeal ratio (Fujioka et al method), Pearson correlation of 0.612 (p value= 0.000). Among these children 56.1% had history of allergic rhinitis, 23.7% had history of reccurent infection, 10.5% had history of both and 9.6% had none. Those with both risk factors had higher proportion of cases with severe degree of obstruction compared to others. Only 4 (3.5%) children had associated tonsillar hypertrophy diagnosed on lateral radiography..

Conclusion

There are 114 children with symptoms suggestive of adenoid hypertrophy, males were more than females. Most of the children showed moderate degree of obstruction on radiography. The mean nasopharyngeal depth was lowest in the 1-3 year old age group while was highest in the 9-12 year old age group. There was no significant statistical difference between males and females mean nasopharyngeal depth.

There was a statistical significant relationship between risk factors and symptoms with degree of obstruction. Also there was a statistical significant relationship between age and degree of obstruction. There were more cases with severe degree of obstruction in the younger age group and less in the higher age groups.

Recommendation

1. Adopt quantitative analysis in assessing patients with adenoid hypertrophy in routine reporting. Fujioka et al method should be adopted in our settings
2. More researches shoul be done on imaging methods for assessment of adenoid hypertrophy.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ANR	Adenoid to nasopharyngeal ratio
CT	Computed Tomography
ENT	Ear, Nose and Throat
MNH	Muhimbili National Hospital
MRI	Magnetic resonance imaging
PNS, STL	Post nasal space, soft tissue lateral
Tsh	Tanzanian shillings
Fig	Figure

1. INTRODUCTION

1.1 BACKGROUND

Adenoid is a mass of lymphoid tissue in the nasopharynx. Its function is to produce antibodies. The size of adenoids varies from child to child and also in the same individual as one grows. The normal adenoids attain the maximum size between the age of 3 and 7 years and then regresses.The effects of adenoids is not in the absolute size but size in relation to the size of nasopharynx.[1]

Adenoids hypertrophy is the most common cause of nasal airway osbruction in children. The risk factors for adenoids hypertrophy are recurrent infections and allergies. A child with adenoid hypertrophy can present with snoring, hyponasal speech or mouth breathing. If not treated it leads to obstructive sleep apnea, ear problems, failure to thrive, cor pulmonale, cardiomegaly, pulmonary oedema and craniofacial anomalies. [1][2][3]

Otitis media occur due to obstruction of eustachian tube which run from the middle ear open into the nasopharynx. Hypoxia which occur in patients with adenoids hypertrophy is believed to lead into increase in pulmonary resistant and pulmonary arterial pressure which leads to right ventricular hypertrophy and hert failure. [19] [20]

Adenoid hypertrophy can be diagnosed clinically, through nasopharyngoscope or PNS, STL radiography. Currently with progression of technology other methods are used in diagnosing adenoid hypertrophy like direct video rhinoscopy and MRI. [1][4][5]

On post nasal space soft tissue lateral radiography the adenoids and nasopharyngeal obstruction have been assesed in different ways through time. These methods are named according to the people who described them. Some of them are Fujioka et al, Johannesson and Cohen and Konak.[6]

Surgery is the treatment of choice for children with adenoid hypertrophy presenting with features of nasal airway obstruction. Intranasal steroids can also be used. Studies which have been done to assess efficacy of intranasl steroids have shown reduction in size of adenoids after using them.[6]

1.2 LITERATURE REVIEW

Adenoid hypertrophy is one of the commonest upper airway disease in children and a cause of obstructive sleep apnea. In a research done in Nigeria the prevalence of adenoids hypertrophy among nasal diseases is reported to be 7.7%. This is third to viral rhinosinusitis and chronic/persistent rhinosinusitis. Adenoidectomy with or without tonsillectomy is the commonest surgical procedure performed on children by ENT specialists.[1][7]

Adenoid hypertrophy is common from 1 year to 12 years old children. The size of adenoid increase as a child grows and attain maximum size between 3 and 7 years then it regresses. Therefore adenoid hypertrophy has high incidence in this age group. Yaseen et al reported the highest incidence of large adenoid is seen in 3-5 years old patients (60%) while the lowest incidence is seen in 9-12 years old patients (18%).[8][9]

The relationship between adenoid hypertrophy and gender varies in different researches. Yaseen et al revealed that males are affected more than females with male: female ratio as 1.1:1 and Josephine et al revealed that females are affected more than males, 45.7% males and 54.3% females.[7] [9]

The nasopharyngeal depth increases as a child grows. Gangadhara et al reported that there is statistically significant increase in nasopharyngeal depth as the age increased. The depth is measured from most posterior point of the hard palate to the basion which is the anterior margin of foramen magnum. In 4-6 years the mean depth is 2.72cm, 7-9 years, it is 3.08cm and in 10-12 years, it reaches 3.35cm. [1][10]

Adenoid on PNS, STL X ray is seen as a well-defined soft tissue dense mass on the roof of nasopharynx. There are many methods of measuring adenoids and degree of obstruction but the commonest is adenoid nasopharyngeal ratio by Fujioka et al.[11] The adenoid nasopharyngeal ratio which show significant nasopharyngeal obstruction and indicative for adenoidectomy is more than 0.7.[10]

The other commonly used method for assessment of adenoid hypertrophy on PNS, STL X ray is by Cohen and Konak. By using Cohen and Konak method it has been shown that there is weak correlation between PNS, STL X-ray findings and presenting symptoms.[12]

Research by Mlynarek et al Cohen and Konak method against symptoms showed no significant correlation and it is weak for Fujioka et al method. The correlation for Cohen and Konak method with total symptoms is shown to be -0.232 with a p value of 0.202 while for Fujioka method is shown to be -0.073 with a p value of 0.690.[4]

The size of adenoids relates with the severity of presenting symptoms. In a research done by Kang et al reported that as the size of adenoids increased apnea also increased. There is significant increase in adenoid size in children presenting with mouth breathing and snoring according to Gangadhara et al. [2][10]

Adenoid hypertrophy is associated with recurrent upper respiratory tract infections and allergic rhinitis.[1]

Research done by Modrzynski and Zawisza shows that adenoid hypertrophy is seen more in research group of cases with allergy to dust mites (40.4%) than in control group (22.3%). Further analysis revealed that the frequency of occurrence of adenoid hypertrophy in the research group varied and depended on the type of the coexisting allergic disease, it is seen more frequently in children who suffered from allergic rhinitis. Positive *Chlamydophila pneumoniae* PCR results are seen in adenoid samples of 13.2 % (7/53) of cases, but none of the controls in a research by Nia et al. In another research in Iran *Mycoplasma pneumoniae*-DNA is detected in 35% (14/40) of cases undergoing adenoid surgery but not in any of the controls. [13] [14][15]

Research done by Szalmas et al shows that bacterial infection is present in 21 patients out of 59 and viral infection is found in 52 patients. Among these 59 patients, 14 had allergic rhinitis.[16]

Hypertrophy of adenoids commonly present with hypertrophy of tonsils. While adenoid hypertrophy diagnosis is confirmed radiologically, the diagnosis of tonsillar hypertrophy is usually made through clinical assessment by ENT specialist.[2][17] In a research by Li et al tonsil size and oropharynx size are assessed on PNS, STL radiography. The tonsil pharyngeal ratio is shown to correlate with obstructive symptoms.[18]

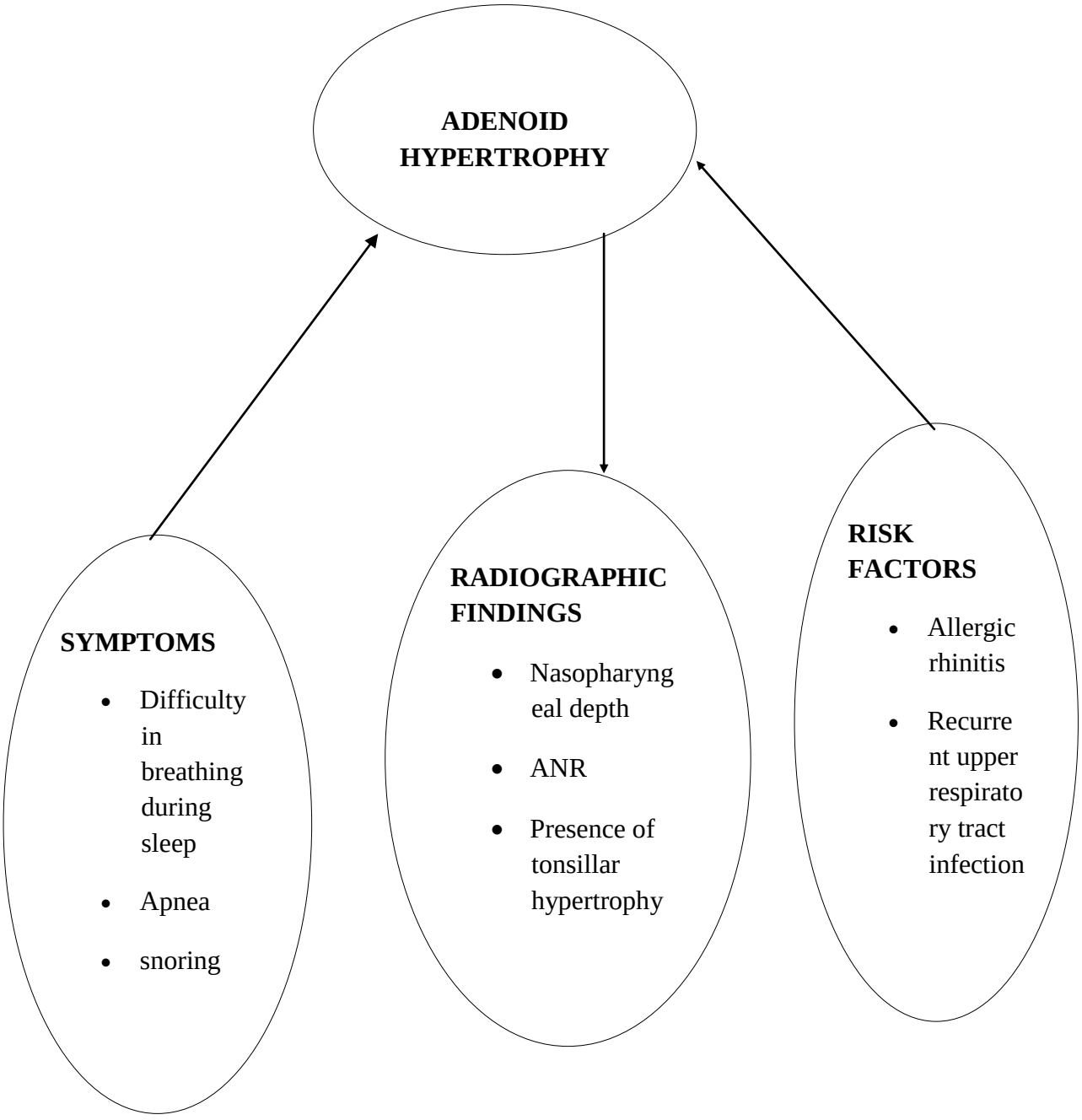
1.3 STATEMENT OF THE PROBLEM

Adenoid hypertrophy is one of the commonest airway disease that affect children. The prevalence in Nigeria has been shown to be 7.7%.[7] Adenoidectomy is one of the commonest ENT surgery in children.

If it is not managed well or there is delay it causes complications ranging from local to distant. The complications include recurrent otitis media with effusion, cardiomegally, cor-pulmonale and pulmonary oedema. All these complications can impair child's development.[20] [21]

PNS, STL radiography are commonly used for diagnosis and follow up of patients due to wide availability and affordability.[22] They provide quantitative information on adenoids and nasopharyngeal space.[1] In children compliance for PNS, STL X-ray is better than video nasal pharyngoscope which is gold standard.[4][23][24] To the scope of this study there is no publication on radiographic findings of adenoid hypertrophy in our country.

1.4 CONCEPTUAL FRAMEWORK



1.5 RATIONALE

Adenoid hypertrophy is a common ENT condition in children and has complications affecting respiratory system, cardiovascular and general growth of a child. The research findings are going to guide in quantitative analysis of adenoid hypertrophy in our country and also be used as baseline data for other researches in Radiology and ENT department.

1.6 RESEARCH QUESTION

1. What radiographic features are common on PNS, STL radiography of children with adenoid hypertrophy at Muhimbili National Hospital?

2. What is the relationship between degree of nasopharyngeal obstruction on PNS, STL X-ray and associated risk factors and presenting symptoms?

1.6 OBJECTIVES

1.6.1 Broad objective

To determine radiographic findings of adenoid hypertrophy and associated risk factors among children attending Muhimbili National Hospital from June to December 2015.

1.6.2 Specific objectives

1. To determine proportion of adenoid hypertrophy according to age and sex among children attending Muhimbili National Hospital.
2. To determine the mean nasopharyngeal depth according to age group and sex among children attending Muhimbili National Hospital.
3. To determine the degree of nasopharyngeal obstruction and associated risk factors among children attending Muhimbili National Hospital.
4. To determine the relationship between the degree of obstruction and presenting symptoms among children attending Muhimbili National Hospital.

2. METHODOLOGY

2.1 Type of research

The research was descriptive cross sectional hospital based research

2.2 Research duration

The research was conducted from June to December, 2015

2.3 Research area

The research was conducted at Radiology department of Muhimbili National Hospital. MNH is the biggest government hospital in Tanzania and it receives referrals from all over the country. It is one of five referral hospitals with ENT department.

The Radiology department has three X ray units, one mammography unit, two ultrasound units, two CT scans and one MRI of 1.5 Tesla.

2.4 Research population

The research included children referred to Radiology department for PNS, STL x-ray due to features of nasal obstruction.

2.5 Inclusion criteria

Children aged from 1 year to 12 years with features of nasal obstruction.

2.6 Exclusion criteria

Children with previous tonsillar or adenoid surgery.

2.7 Patients involved

All children who fulfilled inclusion criteria and parents signed consent form.

2.8 Sampling method

Convenience sampling was used.

2.9 Sample size

The sample size was calculated from Fisher's formula;

$n=Z^2P\ (1-P)/E^2$

Where: n= sample size,

Z = (1.96)

P = prevalence = 7.7%. This is the prevalence of adenoid hypertrophy among children with nasal diseases in Nigeria[5]

95% confidence interval was used.

E = margin error 5%

Therefore $n= (1.96)^2 \times 0.077\ (1 - 0.077)/ (0.05)^2 =109$

We sampled an extra 5% to account for possible non-response

n=109 + 5 (5% of 109)

Thus the sample size in this research was 114 children.

2.10 Collection of data

Data collection was done through structured questionnare which was filled by investigator and image evaluation. Data collected included socio-demographics, clinical symptoms which include snoring, difficulty in breathing and sleep apnea. Risk factors assessed were allergic rhinitis and recurrent upper respiratory tract infections. Radiographic features included adenoid size, nasopharyngeal depth and adenoid nasopharyngeal ratio by Fujioka et al method, average nasopharyngeal depth and presence of enlarged tonsils.

For assessment of risk factors history of the following are enquired; fever, nasal symptoms including congestion, itching, sneezing and rhinorrhea, eye symptoms including itching, conjunctiva edema and hyperemia. History of asthma, eczema, atopic dermatitis and food allergy were also enquired. Allergic rhinitis was considered when a child had history of episodic occurrence of any nasal symptoms with eye symptoms or any other allergic

disease. Recurrent upper respiratory tract infection was considered when a child had recurrence of nasal symptoms with fever**.**

2.11 Imaging and Evaluation

Patients in the research underwent PNS, STL radiography in the Radiology Department of MNH. The radiographs are obtained with the children in the supine position and their neck slightly extended and closed mouth. The X ray machine used was digital Philips, DR/712310, Eindhoven-Best, The Netherland. The x-ray field are collimated to the nasopharynx, with a focus film distance of 1 metre, using average exposure factors of 60 kV and 3.2 milliAmpere-seconds (mAs). The radiographs are taken by the same trained radiographer.

The nasopharyngeal depth are taken as the average of three measurements. Three lines were drawn from the posterior nasal spine; first line to posterior superior sphenobasioccipital area (red line), second line to the nearest adenoidal point (green line) and third to basion of occipital bone (blue line). These are seen in figure 1.

The degree of obstruction is assessed by the adenoid to nasopharynx ratio, proposed by Fujioka et al. Adenoid to nasopharynx ratio is defined as the ratio between the distance along a perpendicular line from the pharyngeal tubercle on the base of the skull to the adenoidal convexity to the distance along a line from the posterior- superior edge of the hard palate to the sphenooccipital synchondrosis on the base of the skull. The measurements are taken by the principal investigator with assistance from a radiologist.[4] the final diagnosis is a consesus of both.

The adenoid nasopharyngeal ratio of < 0.25 is normal, >/= 0.25 to < 0.5 is mild enlargement, >/= 0.5 to < 0.75 is moderate enlargement and adenoid nasopharyngeal ratio more than 0.75 is severe enlargement.

The clinical scoring included the following symptoms: difficulty of breathing during sleep (D), apnea (A), and snoring (S). D and S received a score of 0 (never), 1 (occasionally), 2

(frequently), or 3 (always). Values assigned to A were 0 (when absent) or 1 (when present).

The final score was derived from the following three-variable function:

Patient score=1.42D+1.41A+0.71S− 3.83

Difficulty in breathing meant breathing through the mouth due to difficulty in nasal breathing and restlessness.

Sleep apnea meant interruption of breathing/ stopping breathing repeatedly during sleep.

Patients are categorized according to their score into mild (score below −1), moderate (score between −1 to 3.5), or severe (score above 3.5) groups.

This scoring tool was used in a research by Sharifkashan et al.[12]

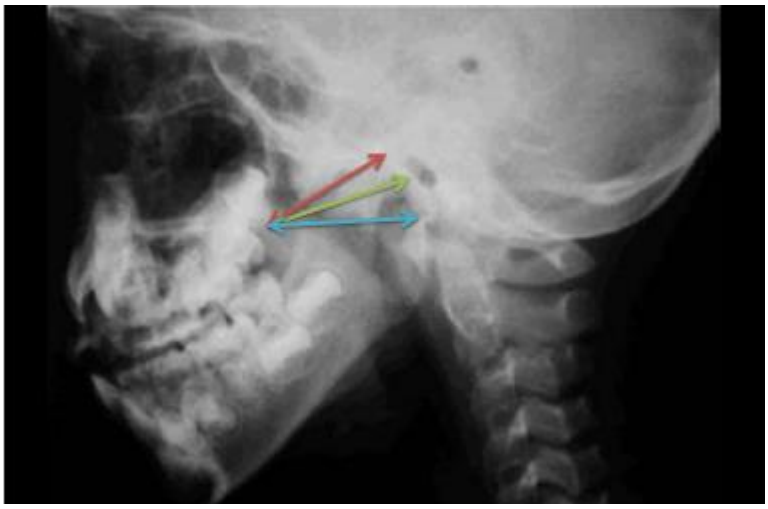


Figure.1 The image is for the nasopharyngeal depth assessment

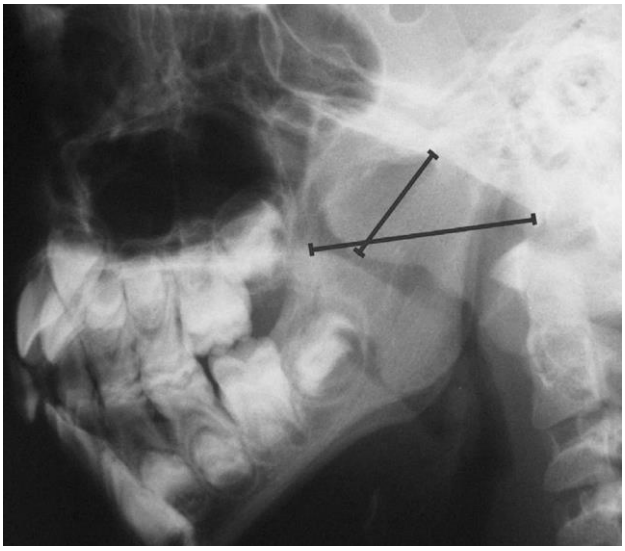


Fig.2 The image shows measurement for adenoid nasopharyngeal ratio

2.12 Data analysis

Data analysis is done using the Statistical Package for Social Sciences (SPSS) version 20. Statistical Association between age, sex, history of allergic rhinitis, history of recurrent nasal infection, symptoms of adenoid hypertrophy and adenoid hypertrophy radiographic findings are done using cross tabulations. Chi-square test is used to compare proportions. P value of < 0.05 is considered statistically significant.

2.13 Ethical consideration

The Researcher introduced herself to the parent or guardian of a child and gave the explanation of the research then requested the parent/guardian to allow the child to participate in the research and assent is obtained from the child. The Interview is conducted in a private room. The parents/guardians who gave consent had their children enrolled in the Research. The interpretation of the Images was done by the principal investigator and Radiologist. The patients information and images findings were confidential. Data was handled confidentially and stored in a secured place.

2.14 Ethical clearance

The proposal is presented to the department of Radiology, Muhimbili University of Health and Allied Sciences. Ethical clearance is thereafter obtained from the Research and Publication Committee of the Muhimbili University of Health and Allied Sciences.

2.15 Research limitation and Mitigation

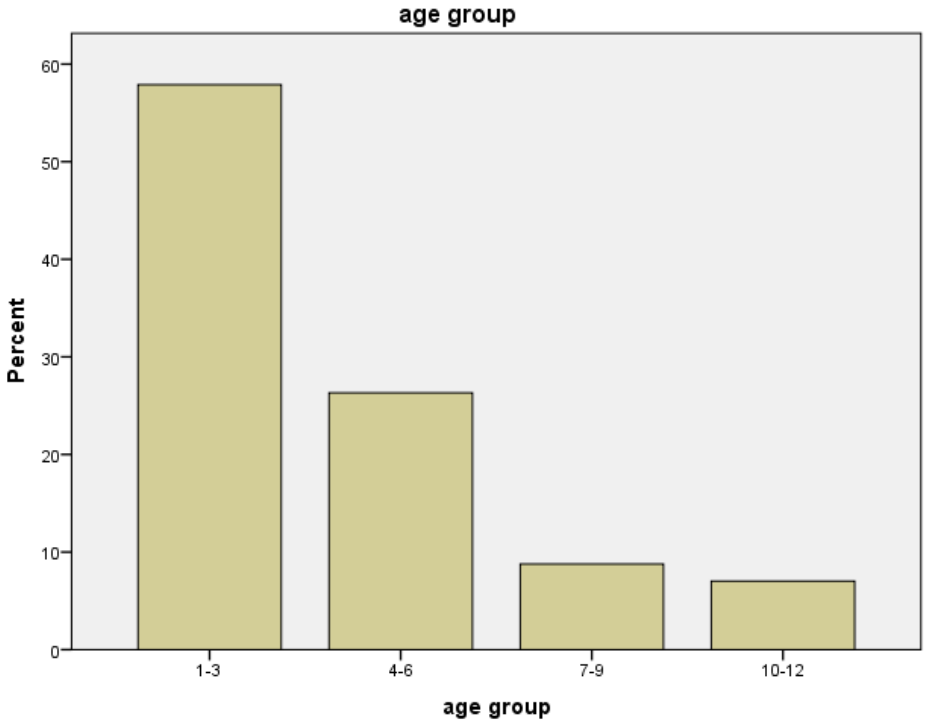
The children are usually restless during imaging and therefore it is difficult in ensuring that the position is correct for obtaining the right measurements. The X rays were done with parent or guardian around to minimize errors.

3. RESULTS

Sociademographic

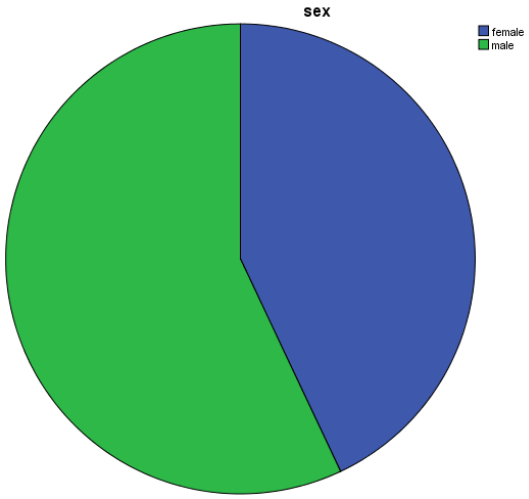
The study included 114 children whose age ranged between 1year to 12 years

Fig 3. Age group frequency distribution bar chart



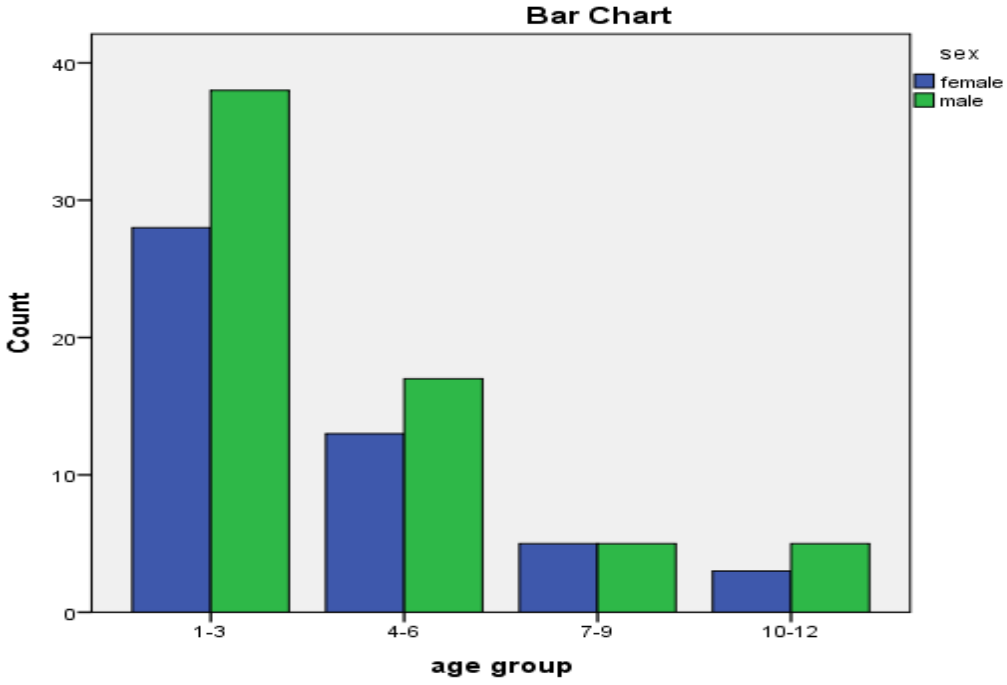
Most of the patients were in 1-3 years old age group (57.9%). The median age was 3 years

Fig 4. Sex frequency distribution pie chart



Male were more (57%) than female patients (43%)

Fig. 5 Age group against sex bar chart



In almost all age groups male cases were more in proportion than female cases, 1-3(57.6:42.4), 4-6(56.7:43.3) and 10-12(62.5:38.5). In the age group 7-9 there were of equal proportion (50:50). (P-value 0.958)

Table 1. The mean nasopharyngeal depth by age group

Age group	N	Mean	Standard deviation
1-3	66	25.95	4.025
4-6	30	31.57	3.014
7-9	10	30.40	3.406
10-12	8	36.63	3.159
Total	114	28.57	4.946

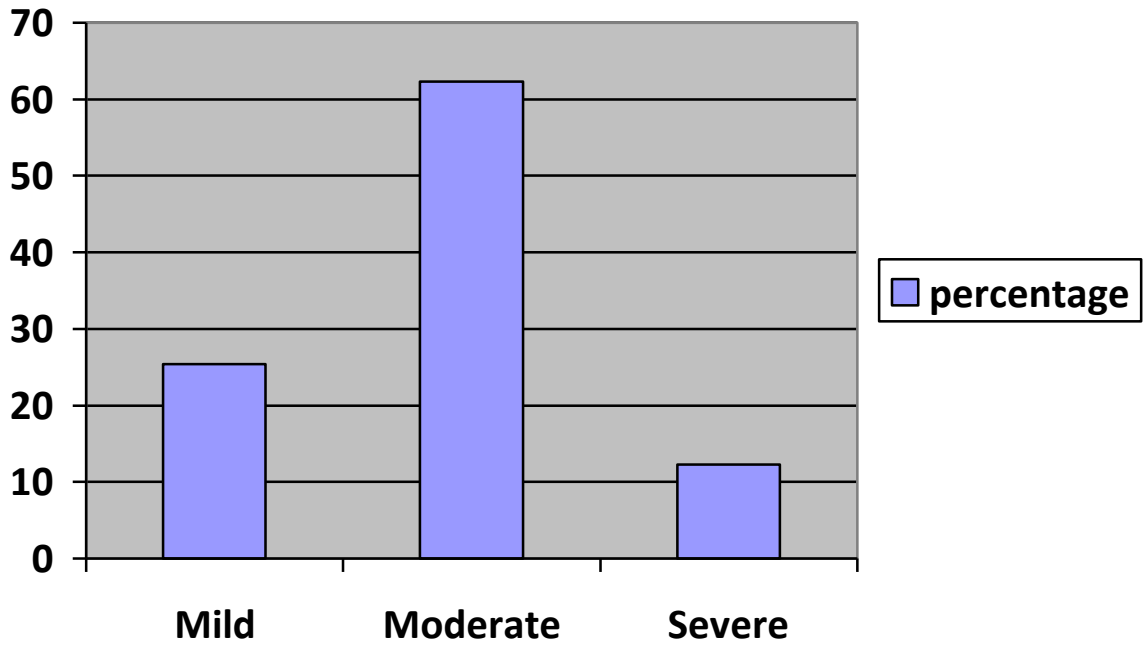
The deepest mean nasopharyngeal depth was 36.63mm in the age group 10 to 12 years and the lowest mean was in the youngest age group which is 25.95. The age group 7-10 had lower mean nasopharyngeal depth than 4-6 age groups

Table 2. The mean nasopharyngeal depth by sex

Sex	N	Mean	Standard deviation
Female	49	28.86	4.958
Male	65	28.35	4.964
Total	114	28.57	4.946

The mean nasopharyngeal depth was similar between males and females.

Fig. 6 Frequency distribution of degree of nasopharyngeal obstruction bar chart



Most of the children had moderate degree of nasopharyngeal obstruction (62.3%), for mild and severe were 25.4% and !2.3% respectively.

Table 3. The degree obstruction by adenoid to nasopharyngeal ratio against age group

Age group	**Adenoid to nasopharyngeal ratio**				**P-value= 0.009**
	Mild	Moderate	Severe	Total	
1-3	9 (13.6%)	45(68.2%)	12(18.2%)	66 (100.0%)	
4-6	10(33.3%)	18 (60.0%)	2 (6.7%)	30 (100.0%)	
7-9	6 (60.0%)	4 (40.0%)	0 (0.0%)	10 (100.0%)	
10-12	4 (50.0%)	4 (50.0%)	0 (0.0%)	8 (100.0%)	

Most patients in the age groups below 7 years had moderate degree of obstruction, 68.2% for 1-3 and 60.0% for 4-6. The youngest group had more patients with severe symptoms (18.2%). The older groups above 6 years had no cases of severe degree of obstruction.

Table 4. The degree of obstruction by adenoid to nasopharyngeal ratio against risk factors

Risk factors	**Adenoid to nasopharyngeal ratio**				**P-value = 0.045**
	Mild	Moderate	Severe	Total	
Allergic rhinitis	19(29.7%)	37(57.8%)	8(12.5%)	64(100%)	
Recurrent infections	3(11.1%)	22(81.5%)	2(7.4%)	27(100%)	
Both	1(8.3%)	8(66.7%)	3(25%)	12(100%)	
None	6(54.5%)	4(36.4%)	1(9.1%)	11(100%)	

Among all the cases, 56.1% had history of allergic rhinitis, 23.7% had history of reccurent infection, 10.5% had history of both and 9.6% had none.

The group with history of both risk factors had highest percentage of patients with severe obstruction (25.0%) and the group with less cases of severe grade of obstruction was those with recurrent infections (7.4%). In all groups of risk factors most patients had moderate degree of obstruction except for the group with none of the risk factors. In the group of none of the risk factors most patients had mild degree of obstruction.

Table 5. The degree of obstruction by adenoid to nasopharyngeal ratio against symptoms grade

Symptoms grade	**Adenoid to nasopharyngeal ratio**				**P-value = 0.045**
	Mild	Moderate	Severe	Total	
Mild	15(88.2%)	2(11.8%)	0(0.0%)	17(100%)	
Moderate	11(19.6%)	44(78.6%)	1(1.8%)	56(100%)	
Severe	3(7.3%)	25(61.0%)	13(31.7%)	41(100)	

The group with severe presenting symptoms had highest percentage (31.7%) of patients with severe degree of obstruction compared to other grades which are 0% for mild and 1.8% for moderate symptoms grade. Those with mild presenting symptoms had highest percentage (88.2%) of patients with mild degree of obstruction. Three children (7.3%) with severe symptoms had mild degree of obstruction.

Table 6. Correlation between degree of obstruction and symptoms score

Correlations

		score	adenoid nasopharyngeal ratio grade
score	Pearson Correlation	1	.612**
	Sig. (2-tailed)		.000
	N	114	114
adenoid nasopharyngeal ratio grade	Pearson Correlation	.612**	1
	Sig. (2-tailed)	.000	
	N	114	114

**. Correlation is significant at the 0.01 level (2-tailed).

There was statistical significance correlation between symptoms score and degree of obstruction.

Table 7. Degree of obstruction by adenoid to nasopharyngeal ratio against each presenting symptom

Presenting symptoms	**Adenoid to nasopharyngeal ratio**			
	Mild	Moderate	Severe	P-value
Difficulty in breathing	25 (86.2%)	70 (98.6%)	14 (100%)	0.016
Snoring	23 (79.3%)	71 (100%)	14 (100%)	0.000
Sleep apnea	1 (3.4%)	15 (21.1%)	9 (64.3%)	0.000

Difficulty in breathing and snoring were present in most of the patients but their proportions were increasing with increase in degree of obstruction, 86.2% and 79.3% for mild, 98.6% and 100% for moderate and 100% for severe respectively. Sleep apnea was present mostly in those with severe degree of obstruction (64.3%), it was 3.4% for mild and 21.1 for moderate obstruction.

There were 4 children with tonsillar hypertrophy seen on radiographs. There was no statistical difference in severity of symptoms between those with tonsillar hypertrophy and those without.

Fig. 7 One of X ray films included in the study

Fig. 8 One of the X ray film excluded in the study

4. DISCUSSION

The research included 114 children who where referred to the Radiology department due to features suggestive of nasal obstruction. Most of the patients had moderate degree of obstruction(62.3%), followed by mild(25.4%) and then severe(12.3%) degree of obstruction.

Moreover most of the patients were in the youngest age group of 1-3 years old and lowest proportion was in the 10-12 years old. This is similar to a research by Yaseen et al. They reported the highest incidence of large adenoid seen in 3-5 years old patients which was the youngest age group in their study while the lowest incidence was seen in 9-12 years old patients. This is explained by the fact that after the age of 7 years, as the child grows the size of adenoid tissue is decreasing.[1] [9]

In addition to that there were more male cases than female cases. This was in a ratio of 1.3:1. The findings are similar to to those found by Yaseen et al who revealed males are affected more than females with male: female ratio of 1.1:1 and different from a research by Josephine et al who revealed that females are affected more than males, 45.7% males and 54.3% females. The difference with the research by Josephine et al is that the number of children with adenoid hypertrophy was smaller and difference in study methodology as they were assessing common nasal diseases in school children. [7] [9]

Furthermore the nasopharyngeal depth increased with increase in age group. The lowest mean nasopharyngeal depth was in the youngest age group (25.95mm) and highest was in oldest age group (36.63mm). The results are similar to those by Gangadhara et al. This is explained by the fact that as the child grows the size of airway also grows. [10]

We also found out that children with history of both allergic rhinitis and recurrent infection had a higher proportion of cases with severe degree of obstruction while children with none of the risk factors had mild degree. The presence of two risk factors causes more proliferation of lymphoid tissue as a way for the body to offer immunity, as a result the growing adenoid tissue causes obstruction of the airway. The findings show relationship between the risk factors and adenoid hypertophy to be similar with other researches.[16]

The severity of obstruction increased with increase in severity of symptoms. Nonetheless there were 3 children (7.3%) who were reported to have severe symptoms but had mild degree of obstruction. This might have been caused by exaggeration of symptoms by parents and guardians as the study based on reported history and not physical examination.

Also the research showed significant correlation between presenting symptoms and degree of obstruction. The Pearson correlation was 0.612 with p-value 0.000. The findings are different from the research by Sharifkashan et al and Mlynarek et al which showed there is weak correlation between PNS, STL X-ray findings and presenting symptoms. The difference can be contributed by the difference in study methodology. [12][4]

In addition to significant correlation between degree of obstruction and symptoms, sleep apnea was present more in cases with severe degree of obstruction. Sixty four percent of children with severe obstruction had sleep apnea. This can be explained by the fact that when sleeping head and neck muscles which help in respiration when awake relax. So if the adenoid tissue is much larger the airway is obstructed completely. These results are similar to the research by Kang et al that reported that as the size of adenoids increase apnea also increases.[2]

We found that only 4 (3.5%) children had associated tonsillar hypertrophy diagnosed on radiography. These results are explained by the fact that patients with tonsillar hypertrophy are diagnosed during clinical assessment and are managed directly after the diagnosis without imaging. Most of the patients had already been assessed at the ENT clinics. [2][17]

Lastly the adenoid nasopharyngeal ratio which show significant nasopharyngeal obstruction and indicative for adenoidectomy is more than 0.7. Therefore using this criteria 17.7% of cases qualified for adenoidectomy. [10]

5.CONCLUSION

There are 114 children with symptoms suggestive of adenoid hypertrophy, males were more than females. Most of the children showed moderate degree of obstruction on radiography.

The mean nasopharyngeal depth was lowest in the 1-3 year old age group while was highest in the 9-12 year old age group. There was no significant statistical difference between males and females mean nasopharyngeal depth.

There was a statistical significant relationship between risk factors and symptoms with degree of obstruction. Also there was a statistical significant relationship between age and degree of obstruction. There were more cases with severe degree of obstruction in the younger age group and less in the higher age groups.

Sleep apnea was present more in cases with severe degree of obstruction while difficulty in breething and snoring were present in most of the cases but increasing in proportion as degree of obstruction increased.

6.RECOMMENDATION

Quantitative assesment of the PNS, STL radiography should be applied in routine reporting of films in the department. The Fujioka method (adenoid to nasopharyngeal ratio) for assessment of degree of obstruction should be adopted. This can guide management of patints and better followup.

The study had limitation of time and resources therefore more researches are required in the cases of adenoid hypertrophy in the community to get prevalence that can be projected to the general population. Also there is a need to do comparison studies with other imaging methods to find out which is best in our community in-terms of effectiveness, cost and risks.

REFERRENCES

[1] A. G. Kerr, J. Groves, and J. N. G. Evans, *Scott-Brown's Otolaryngology Fifth edition*, Fifth. London, 1952, p. chapter 24, pp. 5–15.

[2] K. T. Kang, C. H. Chou, W. C. Weng, P. L. Lee, and W. C. Hsu, "Associations between Adenotonsillar Hypertrophy, Age, and Obesity in Children with Obstructive Sleep Apnea," *PLoS One*, vol. 8, no. 10, pp. 1–8, 2013.

[3] B. Saedi, M. Sadeghi, M. Mojtahed, and H. Mahboubi, "Diagnostic efficacy of different methods in the assessment of adenoid hypertrophy.," *Am. J. Otolaryngol.*, vol. 32, no. 2, pp. 147–151, 2011.

[4] A. Mlynarek, M. A. Tewfik, and A. Hagr, "Lateral Neck Radiography versus Direct Video Rhinoscopy in Assessing Adenoid Size," *he J. Otolaryngol.*, vol. 33, no. 6, pp. 360–365, 2004.

[5] K. Pirila, "Validity of upper airway assessment in children A clinical , cephalometric , and MRI research," *Angle Orthod.*, vol. 81, no. 3, pp. 433–439, 2011.

[6] M. F. N. Feres, H. I. P. de Sousa, S. M. Francisco, and S. S. N. Pignatari, "Reliability of radiographic parameters in adenoid evaluation," *Braz. J. Otorhinolaryngol.*, vol. 78, no. 4, pp. 80–90, 2012.

[7] E. Josephine, A. Eniola, A. Yemisi, and N. Clement, "The prevalence of nasal diseases in Nigerian school children," *J. Med. Med. Sci.*, vol. 5, no. 4, pp. 71–77, 2014.

[8] T. Young, "Intranasal Corticosteroids for Nasal Airway Obstruction in Children with Adenoid Hypertrophy," *Curr. Alllergy Clin. Immunol.*, vol. 21, no. 4, pp. 189–190, 2008.

[9] F. A.-A. Ehab Taha Yaseen, Ammar Hadi Khammas, “Adenoid enlargement assessment by plain X-ray & Nasoendoscopy,” *Iraqi J. Community Med.*, vol. 2012, no. 1, pp. 88–91, 2012.

[10] G. S. K. S, A. Rajeshwari, and M. Jain, “Significance of Adenoid Nasopharyngeal Ratio in the Assessment of Adenoid Hypertrophy in Children,” *Res. Otolaryngol.*, vol. 1, no. 1, pp. 1–5, 2012.

[11] M. Fujioka, L. W. Young, and B. R. Girdany, “Radiographic evaluation of adenoidal size in children: Adenoidal-nasopharyngeal ratio,” *Am. J. Roentgenol.*, vol. 133, no. 3, pp. 401–404, 1979.

[12] S. Sharifkashani, P. Dabirmoghaddam, M. Kheirkhah, and R. Hosseinzadehnik, “A New Clinical Scoring System for Adenoid Hypertrophy in,” *Iran. J. Otorhinolaryngol.*, vol. 27, no. 78, pp. 55–61, 2015.

[13] M. Modrzynski and E. Zawisza, “An analysis of the incidence of adenoid hypertrophy in allergic children,” *Int. J. Pediatr. Otorhinolaryngol.*, vol. 71, pp. 713–719, 2007.

[14] S. J. Nia, V. Zarabi, S. Noorbakhsh, and M. Farhadi, “Chlamydophila pneumoniae Infection Assessment in Children With Adenoid Hypertrophy Concomitant With Rhino Sinusitis,” *Jundishapur J Microbiol*, vol. 7, no. 8, pp. 1–5, 2014.

[15] S. Noorbakhsh, M. Farhadi, A. Tabatabaei, S. G. Darestani, and S. J. Nia, “Searching mycoplasma pneumonia by serology & PCR in children with adenoid hypertrophy and rhinosinusitis: A case control research, Tehran, Iran,” *Iran. J. Microbiol.*, vol. 5, no. 1, pp. 63–67, 2013.

[16] A. Szalmás, Z. Papp, P. Csomor, J. Kónya, I. Sziklai, Z. Szekanecz, and T. Karosi, “Microbiological Profile of Adenoid Hypertrophy Correlates to Clinical Diagnosis in Children,” *Biomed Res. Int.*, vol. 2013, no. 1, pp. 1–11, 2013.

[17] E. Odemis, F. Catal, A. Karadag, H. Kurtaran, N. Ark, and E. Mete, “Assessment of cardiac function and rheumatic heart disease in children with adenotonsillar hypertrophy.,” *J. Natl. Med. Assoc.*, vol. 98, no. 12, pp. 1973–1976, 2006.

[18] a M. Li, E. Wong, J. Kew, S. Hui, and T. F. Fok, “Use of tonsil size in the evaluation of obstructive sleep apnoea.,” *Arch. Dis. Child.*, vol. 87, pp. 156–159, 2002.

[19] Mary, G. F. Jane Luke, Ali Mehrizi, and R. D. Rowe, “Chronic Nasopharyngeal Obstruction As A Cause Of Cardiomegaly , Cor Pulmonale , Pulmonary Edema,” *Am. Acad. Paediatr.*, vol. 37, no. 5, pp. 762–768, 1966.

[20] L. S. D. Khayat, Farhad J, “Incidence of otitis media with effusion in children with adenoid hypertrophy,” *Zanco J. Med. Sci.*, vol. 15, no. 2, pp. 57–63, 2011.

[21] H. S. Satish and A. N. Anjan, “A Research on Role of Adenoidectomy in Otitis Media with Effusion,” *J. Dent. Med. Sci.*, vol. 4, no. 6, pp. 20–24, 2013.

[22] S. Mohebbi, M. B. Rahmati, P. Omidian, and M. M. Monzavi, “Assessment of Intranasal Steroid Effect in Management of Adenoid Hypertrophy in Children between 2-11 Years Old,” *J. Pharm. Pharmacol.*, vol. 2, pp. 211–217, 2014.

[23] S. Gupta, Vipan, Gupta, Monica, Matreja, Prithpal. S, Singh, “Efficacy of Mometasone Nasal Spray in Children with Snoring due to Adenoids,” *Clin. Rhinol. An Int. J.*, vol. 7, no. 1, pp. 1–4, 2014.

[24] S. Hamid, “The Effect of Mometasone Furoate Nasal Spray on Adenoid Hypertrophy and Its Related Obstructive Sleep Apnea in Pediatric Age Group,” *INDIAN J. Appl. Res.*, vol. 3, no. 10, pp. 8–10, 2013.

APPENDICES

Appendix I: Questionnaire

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

SCHOOL OF MEDICINE - DEPARTMENT OF RADIOLOGY

P.O.BOX 65001 MUHIMBILI

DAR ES SALAAM

TANZANIA

Identity number ……. Age …… Sex F/M

Part 1

Presenting symptom; Symptom score _____

Difficulty in breathing during sleep 1. Yes 2. No

If yes 1. Occasional 2. Frequently 3. Always

Snoring 1.Yes 2.No

If yes 1. Occasional 2. Frequently 3. Always

Sleep apnea 1.Yes 2.No

Risk factors

Allergic rhinitis 1.Yes 2.No

Recurrent infection 1.Yes 2.No

Part 2. Image findings

Mean nasopharyngeal depth……

Adenoid nasopharyngeal ratio……

Airway to soft palate ratio.....

Tonsillar hypertrophy 1. Present 2. Absent

QUESTIONS TO ASSESS RISK FACTORS

Nasal symptoms

- Congestion
- Itching
- Sneezing
- Rhinorrhea

Eye symptoms

- Itching
- Conjunctiva edema
- Hyperemia.

History of

- Atopic dermatitis
- Food allergy
- Asthma

Fever

Conclusion

Allergic rhinitis if a child has history of episodic occurrence of any nasal symptoms with eye symptoms or any other allergic disease

Recurrent upper respiratory tract infection if a child has recurrence of nasal symptoms with fever

Appendix II: Consent Form(English Version)

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

DIRECTORATE OF RESEARCH AND PUBLICATIONS, MUHAS

ID-NO……

Consent to Participate in a Research

My name is Dr. Cecilia Ngatunga; I am conducting research on adenoid hypertrophy among children referred for PNS, STL X-ray to Radiology department at MNH.

Research Purpose

The research is conducted as partial fulfillment of the requirements of Mmed. Radiology at MUHAS. The research is also conducted to establish reference parameters which can be used for diagnosis and follow up in our department.

How to be involved

The parents who agree for their children to participate in this research will be required to sign the consent form, then interviewed after that.

Confidentiality

The information obtained from you will be confidential. No name will appear on any document of this research instead Identification numbers will be used.

Participation and right to Withdraw

Involvement in this research is voluntary. You can participate or refuse to participate from this research. Refusal to participate from this research will not interfere with your management.

Benefits

The information that you provide will help us to correlate the radiographic findings among children with adenoid hypertrophy and associated risk factors and presenting symptoms. Thus the research outcomes will help to improve patients' management thus improve quality of life.

Contact Personel

If you ever have questions about this research, you should contact the Principal Investigator, Dr. Cecilia Ngatunga, Muhimbili University of Health and Allied Sciences, P. O. Box 65001, Dar es Salaam. Tel. 0713 644 195**.**

OR in case you have questions about your rights of participation in this research you may contact

Prof Aboud, M.M Chairperson of the Senate Research and Publications Committee,

P. O. Box 65001 DSM. Telephone +255 2152467

Dr. Mboka Jacob who is the supervisor of this research

Tel. +255 715 828 834

Participant agrees ……..

I ……. have read the contents in this form. My questions have been answered. I am willing to participate in this research.

Signature of participant …… Date…….…….....

Signature of Researcher …….. Date…….....

Appendix III: Consent Form (Swahili Version)

CHUO KIKUU CHA SAYANSI ZA AFYA MUHIMBILI

KURUGENZI YA TAFITI NA UCHAPISHAJI

FOMU YA RIDHAA

Namba ya utambulisho ---

Ridhaa ya kushiriki kwenye utafiti

Jina langu ni Dr. Cecilia Ngatunga nafanya utafiti wenye lengo la kuangalia adenoid hypertrophy kwa watoto wanaofanyiwa X-ray ya kichwa kwenye idara ya vipimo vya mionzi katika Hopitali ya Taifa Muhimbili.

Madhumuni ya Utafiti huu ni pamoja na kutimiza sehemu ya matakwa ya shahada ya uzamili

ya matibabu kitengo cha vipimo vya mionzi Chuo Kikuu cha Afya na Sayansi ya Tiba

Muhimbili. Hali kadhalika kupata vipimo ambavyo vinaweza kutumika kwenye matibabu ya watoto.

Jinsi ya kushiriki

Ukikubali mtoto kushiriki katika utafiti huu, utasailiwa alafu utatakiwa kujibu maswali kutoka

kwenye dodoso lililoandaliwa alafu mtoto ataendelea na kipimo kama kawaida.

Usiri

Taarifa zote zitakazokusanywa kupitia dodoso hili zitakuwa ni siri. Jina lako halitatumika

badala yake tutatumia namba ya utambulisho.

Uhuru wa kushiriki na haki ya kujitoa

Kushiriki kwenye utafiti huu ni hiari. Unaweza kushiriki au kukataa kushiriki na hii haitakuondolea haki ya kupata matibabu yako.

Nani wa kuisiliana naye

Kama una maswali kuhusiana na utafiti huu, wasiliana na mtafiti mkuu, Dr.Cecilia Ngatunga, Chuo Kikuu cha Afya na Sayansi ya Tiba Muhimbili, S. L. P. 65001, Dar es Salaam. Simu 0713 644 195.

Prof Aboud, M. M**,** Mwenyekiti wa kamati ya Utafiti na Uchapishaji, S.L.P 65001,

Dar es Salaam. Simu +255 022 2152467 au msimamizi wa utafiti huu Dr. Mboka Jacob.

Simu 0715 828 834

Kama umekubali kushiriki weka sahihi

Mshiriki nimekubali …….....

Mimi..... nimesoma maelezo ya fomu hii nimeyaelewa na nimekubali kushiriki katika utafiti huu.

Sahihi ya mshiriki…… Tarehe ya kutia sahihi…….....

Sahihi ya mtafiti…… Tarehe ya kutia sahihi…….