

## Echocardiographic Characteristics of Nigerian Children with Adenoidal Hypertrophy: A Multicenter Study

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Received date: October 27, 2016; Accepted date: November 07, 2016; Published date: November 14, 2016

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### Abstract

**Background:** Adenoidal hypertrophy is a common respiratory disease in childhood with a lethal complication of Cor-Pulmonale. There are few studies on the prevalence of adenoidal hypertrophy in children in Nigeria. The aim of the current study is to document the echocardiographic characteristics of Nigerian Children with adenoidal hypertrophy and compare the findings with those of other children in other parts of the world.

**Method:** The study was prospective, involving subjects from three centers which were; a tertiary hospital, a private hospital and a major cardiology center. Children with clinical and radiological diagnosis of adenoidal hypertrophy had transthoracic echocardiography done by a cardiologist.

**Results:** A total of 1,346 children had echocardiography done within the three years studied period in the centers. In all, 128 had adenoidal hypertrophy with a prevalence of 9.5%. Prevalence of pulmonary hypertension was 5.47% in subjects with adenoidal hypertrophy. More than 90% of the children with adenoidal hypertrophy had normal echocardiographic findings.

**Conclusion:** Most Nigeria children with adenoidal hypertrophy had normal echocardiographic findings but some (5.5%) had abnormal echocardiographic findings. The prevalence of pulmonary hypertension among Nigerian Children with adenoidal hypertrophy is 5.5%. This is lower than that reported in subjects from other parts of the world.

**Keywords:** Adenoidal hypertrophy; Children; Echocardiography; Cardiac; Complications

### Introduction

Adenoidal hypertrophy is a common presentation in childhood [1]. It is the commonest cause of chronic nasal obstruction and sleep apnoea disorder. It accounts for 48.9% of throat disorder in children that presents to the hospital [2]. The prevalence of adenoidal hypertrophy varies from region to region with environmental factors being a causative factor of this variance [3].

In a questionnaire based study by Aydin et al. [4] in four primary schools in Turkey, the prevalence of adenoidal hypertrophy were 27%, 19.5% and 19.9% of age strata of 5 to 7 years, 8 to 10 years and 11 to 14 years pupils respectively.

In Nigeria, the prevalence of adenoidal hypertrophy in primary schools studied by Eziyi et al. [5] was 7.7% while a private hospital based study by Chinawa et al. [6] had a prevalence of 1.3%. The lower prevalence in these Nigerian studies compared to the study by Aydin et al. [4] could be as a result of variation due to environmental factors and in addition, Chinawa et al. [6] had data limited to a private hospital.

Chronic hypoxaemia from prolonged adenoidal hypertrophy can result in structural alteration of the vascular beds, increase in pulmonary vascular resistance, pulmonary hypertension and cor-

pulmonale [7]. Pulmonary function abnormalities occur in 65.7% of children with adenotonsillar hypertrophy, [8] and there is increase morbidity and mortality in children with cardiac complications of adenotonsillar hypertrophy especially those with severe corpulmonale [9].

The prevalence of pulmonary hypertension in a study by Moghaddam et al. [10] in Iran was 7.3%. This was seen following preoperative echocardiography in fifty-five subjects age ranged 4 to 14 years. This is similar to the prevalence of 7.14% in a study by Sebusianil et al. [11] on fourteen children in Sao Paulo. A higher prevalence of pulmonary hypertension was seen in a study by Marangu et al. [12] in Kenya. Echocardiography was done on 123 children below twelve years that had clinical and radiological diagnosis of adenoidal hypertrophy and pulmonary hypertension was seen in 21.9% of the subjects.

Studies have shown a reversal of preoperative echocardiography findings following operation but there is increase mortality when treatment is not instituted early and the need for echocardiography prior surgery and post operatively cannot be overemphasized [8]. Moreover, echocardiography findings of right ventricular involvement without any clinical sign have been documented [13].

Although there have been reports on the prevalence of adenoidal hypertrophy in Nigeria, none of the studies involved echocardiography and its findings in this cohort of patients, the studies also were each from a single centre and involved very few subjects. The research question in the current study were:

- What are the echocardiographic findings of Nigerian Children with adenoidal hypertrophy?
- What is the prevalence of pulmonary hypertension among Nigerian Children with adenoidal hypertrophy?

The aim of the current study is to document the echocardiographic characteristics of Nigerian Children with adenoidal hypertrophy and compare the findings with those of other children in other parts of the world. The findings in this current study will not only help to increase the awareness of the need for early diagnosis and prompt treatment but also emphasize the importance of cardiac evaluation in children with adenoidal hypertrophy.

### Subjects and Methods

This prospective study was carried out in three centers in Lagos State, Nigeria. The centers were Lagos State University Teaching Hospital (LASUTH), Ikeja, Reddington Multispecialty Hospital, Victoria Island, Lagos and Clinic du Merci.

The Lagos State University Teaching Hospital is a tertiary center with referrals from different hospitals both public and private within and outside Lagos State. The Department of Paediatrics in this center has a well established cardiology unit and regular echocardiography is done by the Paediatric Cardiologist.

The Reddington Multi-Specialist Hospital is a one-stop comprehensive tertiary hospital which provides a solution to various healthcare problems. It is located on the Victoria Island part of Lagos which is the commercial capital of Nigeria. The hospital provides care in all fields of Internal Medicine, including its special expertise in Cardiology, with its own Coronary and Intensive Care Unit. It also provides Renal Dialysis, Obstetrics and Gynecology, Paediatrics and Paediatric Cardiology, Surgery (including Endoscopy and Day-case Surgery), Ophthalmology, ENT (Ear, Nose, and Throat) Surgery, Radiology, and Psychiatry. The hospital has facilities for inpatients and outpatient care.

Clinic du Merci is a private multispecialty Paediatric clinic. It is located on the mainland and offer specialist and diagnostic Paediatric services which includes cardiac evaluations in children.

This present study included all children with clinical and radiological diagnosis of adenoidal hypertrophy between the periods of January 2013 to December 2015.

Transthoracic Echocardiography was done according to the American Standard on Echocardiography using a 2-D echocardiography machine with facility for colored Doppler and M-mode. The Paediatric cardiologists performed the echocardiography on all the study subjects. Details concerning the patient's biodata, clinical presentation, and echocardiographic diagnosis, and other relevant information were recorded prospectively. The data were analyzed using Microsoft Excel supplemented by the Statistical Package for Social Sciences (SPSS) version [20]. The children's age, sex, indication for echocardiography and echocardiographic findings were represented in tables and charts. Descriptive statistic was presented as percentages or means and standard deviation. Means of normally distributed variables were compared using the Student T test and proportions using Chi-square test. The level of significance set at  $p < 0.05$ .

Pulmonary artery pressure was calculated using Bernoulli equation of  $4 \times TRV2$  (tricuspid regurgitation velocity) +RAP (right atrial

pressure) [14]. Mean pulmonary artery pressure (mPAP) was estimated using the formula  $mPAP = 0.61 \times sPAP$  (systolic pulmonary artery pressure) +2. Diagnosis of pulmonary hypertension was made with  $mPAP \geq 25$  mmHg. Further classification into mild, moderate and severe PAP was done with mPAP between 25 and 40mmHg, 40 to 55mmHg and above 55mmHg respectively [15].

### Results

The total number of children that had echocardiography done in the three centers within the study period was 1,346. Adenoidal hypertrophy was the indication for echocardiography in 128 (9.5%) of them. The mean age at echocardiography for all subjects was 4.07 years. The age ranged at evaluation in all subjects was 5 months to 13 years (Table 1).

The highest number of subjects evaluated was seen in LASUTH with 67 subjects. Total subjects that had echocardiographs done at Clinic du Merci and Reddington Hospital were 31 and 30 respectively. The male to female ratio of all subjects was 2:1 (Table 2).

Centres			
Gender	LASUTH	Clinic du Merci	Reddington
Male	48(71.6%)	20(64.5%)	18(60.0%)
Female	19(28.4%)	11(35.5%)	12(30.0%)
Age group (years)			
<5	49(73.1%)	23(74.2%)	18(60%)
>5	18(26.9%)	8(25.8%)	12(40.0%)

**Table 1:** Age group and gender of the subjects.

	Age at Echocardiography (Months)	Sex	sPAP(mmHg)	mPAP(mmHg)
1	12	Male	40	26.4
2	13	Female	50	32.5
3	21	Male	65	41.7
4	24	Male	67	42.9
5	25	Male	70	44.7
6	36	Female	70	44.7
7	72	Female	80	50.8

**Table 2:** Demographic and Echocardiography Findings of Subjects with Pulmonary Hypertension.

In LASUTH, 668 children had echocardiography done within the three years studied period and 10.0% of subjects had echocardiography done for adenoidal hypertrophy. The mean age at echocardiography for subjects with adenoidal hypertrophy was 3.7 years with a median age of 2.8 years.

A total number of 500 children had echocardiography done in Clinic du Merci within the studied period and 6.0% of the subjects had adenoidal hypertrophy. The mean age at echocardiography evaluation

in subjects with adenoidal hypertrophy was 4 years and the median age was 3.3 years.

At Reddington Hospital, 178 subjects had echocardiography done within the studied period and in 30 (16.9%) of them, the indication for cardiac evaluation was adenoidal hypertrophy. The mean age at evaluation in the thirty subjects was 4.8 years while the median age was 3.75 years. In all the three centers, the difference in the mean age was not statistically different with *p* value of 0.100 (Figure 1).

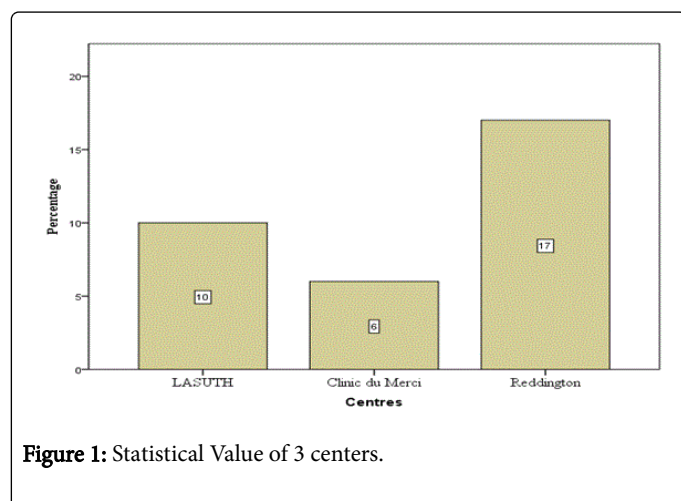


Figure 1: Statistical Value of 3 centers.

Pulmonary hypertension was seen in seven out of all subjects that had echocardiography with a prevalence of 5.47%. Six of the cases were seen in LASUTH and one case was diagnosed at Clinique du Mercei. Only one of the subjects with pulmonary hypertension was above 5 years. There was no statistically difference in the age of occurrence of pulmonary hypertension in these subjects. (*p*=0.122). Two subjects with moderate pulmonary hypertension had right ventricular dysfunction.

In all subjects with pulmonary hypertension, sPAP was at least 40mmHg (mPAP was  $\geq$  26.4mmHg). Two subjects had mild PAH, while the rest had moderate PAH.

## Discussion

The prevalence of adenoidal hypertrophy in this present study is 9.5%. This finding is higher than other studies in Nigeria by Eziyi et al. [5] and Chinawa et al. [6]. The possibility for the disparity is possibly due to a wider representation of subjects in both government and private facilities with high influx of patients compared to Chinawa et al. [6] study where only one private hospital was used as well as the limitation in questionnaire based study done by Eziyi et al. [5].

The prevalence of adenoidal hypertrophy is however significantly lower in the current study than studies by Abreu et al. [16] in Brazil and Bitar et al. [17] in America with a prevalence of 79.2% and 57.7% respectively. The possible explanation for the wide disparity is likely due to the contributory effect of the environment.

The prevalence of adenoidal hypertrophy was significantly higher in males than females in this present study. This is similar to the findings by Chinawa et al. [6] and Evcimik et al. [18] Mukai [19] also reported that number of males that had tonsillectomy was 2.3 times higher than females. The possibility of the higher number of males that had tonsillectomy was stated to be due to the finding of more males with hypertrophied tonsils than females.

Mean age of subjects at echocardiography in this present study was 4.07 years. This is higher than the mean age of 2.71 years at presentation reported by Chinawa et al. [6] (Although echocardiography was not done for the subjects reported by these authors). The possible reason for the disparity in the mean age of subjects could be as a result disparity in the age range of subjects studied. While this current study had a maximum age of thirteen years, Chinawa et al. [6] had a limitation to a maximum age of five years. The mean age at echocardiography in subjects evaluated in LASUTH was the lowest while subjects evaluated at Reddington hospital had the highest mean age though the difference in the mean age in all centers was not statistically significant. In all the centres, a higher proportion of the subjects were below five years of age. This is in keeping with the stated peak age of adenoid and adenoidal hypertrophy of two to six years. Also, it corresponds to the peak age of obstructive sleep apnoea syndrome which is a major clinical presentation of adenoidal hypertrophy. The explanation for this is because this is the age range when the tonsils are largest in relation to the airway size.

The prevalence of pulmonary hypertension in this present studied was 5.47%. This is lower than a prevalence of 36% reported by Martha et al. [20]. In this current study all subjects with adenoid or adenoidal hypertrophy irrespective of need or time of surgery were reviewed but Martha et al. [20] recruited subjects prepared for adenotonsillectomy. Hence, possibility of a more severe disease in subjects reviewed by Martha et al. [20] that would have caused the high prevalence in subjects with pulmonary hypertension. No immediate explanation can be given for the lower prevalence of pulmonary artery hypertension in this study compared to the study by Marangu et al. [12] despite the same cut-off value for the diagnosis of pulmonary hypertension. Sebusianil [11] recruited subjects with indication for adenotonsillectomy and this in addition to a small sample size of fourteen subjects could have resulted in the higher prevalence of 7.14% in the study and the bias of random selection of cases by Moghaddam et al. [10] could have also accounted for the higher prevalence of 7.2% in the study.

All but one case of pulmonary hypertension was seen in LASUTH despite a mean lower age of cardiac evaluation in those subjects. Marangu et al. [12] also reported a lower mean age in subjects with pulmonary hypertension. The possibly reason could be a higher disease severity in subjects that presented in LASUTH that could have led to early progression to pulmonary hypertension.

In 71.4% of subjects that had pulmonary hypertension, a moderate form of the complication was seen and two of them had right ventricular dysfunction. The post operative complication of respiratory arrest that can occur in persons with Cor-Pulmonale has been documented [21]. This occurs from sudden withdrawal of the chronic hypoxic driving force for respiration following surgical operation. There is need for echocardiography in children with adenoidal hypertrophy, this will help to identify those at risk of post operative complications and hence provide anticipatory management which will help to reduce mortality that can occur from the surgery.

## Conclusion

Adenoidal hypertrophy is a common presentation in our environment. Most Nigeria children with adenoidal hypertrophy had normal echocardiographic findings but some (5.5%) had abnormal echocardiographic findings. The prevalence of pulmonary hypertension among Nigerian Children with adenoidal hypertrophy is

5.5%. This is lower than that reported in subjects from other parts of the world. There is need for routine echocardiography as part of the evaluation of children with adenoidal hypertrophy, and pre-operative work up. This will enable the care provider detect cardiac complications of adenoidal hypertrophy early and provide anticipatory management so as to reduce the mortality that can occur from the cardiac complications.

## Acknowledgement

We gratefully acknowledge all the subjects who were part of this study, their caregivers and parents including all the staff involved in their care.

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