Original Article

# Comparison of Flexible Nasopharyngoscopy with Plain Radiograph in the Assessment of Children with Adenoid Hypertrophy


## Abstract

**Background:** Obstructive adenoid hypertrophy is one of the commonest disorder seen in paediatric otorhinolaryngology clinics. It has a wide range of complications that can lead to cardiopulmonary and developmental problems; hence, early diagnosis and treatment are paramount in preventing the complications. Several modalities for the assessment of adenoid hypertrophy have been described in the literature, of which plain radiograph and flexible nasopharyngoscopy are the most popular. In this study, traditional method of evaluating adenoid hypertrophy (plain radiograph) has been compared with newer flexible nasopharyngoscopy. **Materials and Methods:** This is a cross-sectional study of randomly selected children with clinical diagnosis of obstructive adenoid disease. All eligible participants underwent clinical examinations, flexible nasopharyngoscopy and postnasal space X-ray. The findings were compared using the chi-square test and Pearson's correlation test. **Results:** The age of the participants ranged between 2 and 10 years with mean of 4.5 ± 2.5 years. There were 79 (56.4%) males and 61 (43.6%) females. The adenoid hypertrophy observed using flexible nasopharyngoscopy among the participants ranged between 20 and 90% with mean of 67.4 ± 15.4%. The adenoid enlargement measured using adenoidal–nasopharyngeal ratio on plain radiograph ranged between 0.40 and 0.96 with mean of 0.7 ± 0.09. The Pearson's correlation test revealed strong correlation between flexible nasopharyngoscopy and plain radiograph ($r$ = 0.858, $P$ = .000), and there was statistically significant association between the two methods ($\chi^2$ = 148.8, $P$ = .000). **Conclusion:** There was a strong correlation between flexible nasopharyngoscopy and plain radiograph of the postnasal space in the assessment of obstructive adenoid disease in children.


**Keywords:** *Adenoid hypertrophy, comparison, flexible nasopharyngoscopy, postnasal space X-ray*


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**Received:** 07-Jan-2022
**Accepted:** 27-Feb-2022
**Published:** 08-Jun-2022



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**Access this article online**
**Website:** www.jwacs-jcoac.org
**DOI:** 10.4103/jwas.jwas_37_22
**Quick Response Code:**


## Introduction

Obstructive adenoid hypertrophy is one of the commonest childhood disorders encountered in otorhinolaryngology practice worldwide. It is responsible for a high number of medical visits to hospitals, and it is one of the main reasons given for parent absence at work places.[1,2] In Nigeria, obstructive adenoid hypertrophy was also found to be one of the common disorders seen in paediatric otorhinolaryngology clinics.[3] The prevalence varies across the regions: 18.55% was reported in Port Harcourt,[3] 9.2% was recorded in Ibadan,[4] 7.7% was seen among primary school children in Ile-Ife,[5] and the least prevalence of 4.9% was reported among hospitalised patients in Sokoto.[6]

Adenoid hypertrophy is the commonest cause of nasopharyngeal airway obstruction in children.[7] It has a wide range of complications that can lead to cardiopulmonary and developmental problems such as obstructive sleep apnoea syndrome, pulmonary hypertension, cardiac failure, and eventually failure to thrive.[8-10] Therefore, early diagnosis and treatment are paramount before the complications set in.

Several modalities for the assessment of adenoid hypertrophy have been described in the literature, of which plain radiograph and flexible nasopharyngoscopy are the most popular, but there is no conclusive agreement on the best and universally applicable method of assessment.[11] Flexible nasopharyngoscopy is currently recommended by some authors; it was found to be an accurate, reliable, and safe diagnostic procedure, and it also provides a definitive assessment of the status of both the nasal cavity and nasopharynx.[12,13] However, it has drawbacks as well; it is prone to subjectivity as it relies on professional opinion and judgment, and some workers reported poor inter-rater reliability and low inter-observer agreement. It is also expensive and not universally available, especially in sub-Saharan Africa.[14-16]



**How to cite this article:** Adamu A, Jibril YN, Hasheem MG, Abdullahi H, Salisu AD, Nwaorgu OG. Comparison of flexible nasopharyngoscopy with plain radiograph in the assessment of children with adenoid hypertrophy. J West Afr Coll Surg 2020;10:6-10.

On the other hand, plain radiograph is the most widely used investigative method for the assessment of adenoid hypertrophy. It is an objective method of assessment, especially when cephalometric measurements (like adenoidal–nasopharyngeal ratio [ANR]) are employed for interpretation. It is readily available, cheap, and easy to interpret. However, it has been criticised by some researchers due to its low accuracy and precision, inter-observer error, inability to compel a child to assume standard position during the procedure, and exposure to radiation.[17] Although radiation exposure to children from radiological imaging has been an area of debate,[18] some authors have reported that children are particularly more sensitive to radiation exposure and children exposed to radiation have two- to three-fold increased risk of developing cancer than adults.[18,19] Similarly, another report also indicated that even low-dose radiation can predispose children to cancer later in life.[20] Despite these shortcomings, plain radiographs are still used in many developing countries, where facilities for the newer assessment methods are not available. Therefore, this study aims to determine the degree of agreement between the traditional plain radiograph and a newer flexible nasopharyngoscopy in the assessment of adenoid hypertrophy in our environment.

## Materials and Methods

The study was a hospital-based cross-sectional study conducted at the ENT clinic of Aminu Kano Teaching Hospital between October 2018 and December 2019. Ethical approval was obtained from the institution's research and ethics committees with reference number NHREC/21/08/2008/AKTH/EC/2398. Informed consent was obtained from the parent of each study participant. The participant included in the study were children with clinical diagnosis of obstructive adenoid disease who presented during the study period. Children excluded from the study were those with nasal mass, craniofacial anomaly, and bleeding disorder; uncooperative patients; or those who had adenoidectomy previously. Simple random sampling technique (by balloting) was used to recruit the participants. A structured questionnaire was used to collect relevant clinical information using the interviewer-administered method.

Flexible nasopharyngoscopy was performed under the aseptic technique; the participant was made to sit comfortably on a chair supported by the parent/caregiver or restrained on the caregiver's lap depending on the age of the child. Nasal examination was carried out with a bright headlamp. For patients found with nasal discharge, cleaning and suctioning were carried out using an appropriate size flexible suction catheter. Patients with gross nasal mass were excluded from the study. Xylocaine spray 10% (10 mg/metered dose) was applied into both nasal cavities (1–2 metered dose) to anaesthetise the nasal mucosa, to ease the procedure, and to reduce discomfort. Additionally, xylometazoline nasal spray 0.05% (two to three drops) was applied into the nose for a participant with engorged inferior turbinate. Five minutes was given for xylocaine and/or xylometazoline to take effect. A flexible nasopharyngoscope (Model No: 68E3566M, diameter: 2.7 mm; Medtronic Xomed, Florida) was used for the procedure. The scope was disinfected and lubricated before introduction into the nose. Defogging of the flexible nasopharyngoscope was done by wiping the tip of the scope with a piece of cotton wool soaked in Savlon. The tip of the scope was passed into the most spacious nasal cavity along the floor of the nasal cavity to examine the choanae, the nasopharynx, and Eustachian tube openings. The nasopharynx was examined in upright and clear endoscopic view, and the finding was recorded as a percentage of obstruction of the choanae. The result was further grouped according to endoscopic grading described by Yazici *et al.*[21] (grade 1: adenoid hypertrophy obstructing <50% of choanae, grade 2: adenoid hypertrophy obstructing 50–75% of choanae, and grade 3: adenoid hypertrophy obstructing 76–100% of choanae).

A digital plain radiograph of the postnasal space (lateral view) was done at the radiology department of the institution. It was taken in an erect posture, with the head of the patient fixed in a true lateral direction. The Fujioka *et al.*[22] method of ANR was used for grading of the adenoid hypertrophy on plain radiograph. The ANR was further grouped into mild obstruction (ANR = 0.50–0.62), moderate obstruction (ANR = 0.63–0.75), and severe obstruction (ANR ≥ 0.76). The measurements of ANR on plain radiograph were made several days after the flexible nasopharyngoscopic examination, and the authors were blinded to the findings of the endoscopy.

The data obtained were analysed using Statistical Product and Service Solutions version 20.0 for Windows (IBM Inc., Chicago, Illinois). Data were summarised as quantitative and qualitative variables. Quantitative variables were expressed as mean and standard deviation (SD). Qualitative variables were expressed as frequencies and percentages. The chi-square test was used to compare the association between the qualitative variables, whereas the Pearson's correlation test was used to compare the relationship between the quantitative variables. The level of statistical significance was set at $P$ value ≤ .05, 95% confidence interval.

## Results

The age of the participants ranged between 2 and 10 years, with mean ± SD = 4.5 ± 2.5 years. There were 79 (56.4%) males and 61 (43.6%) females with male to female ratio of 1:08. The adenoid obstruction observed using flexible nasopharyngoscopy among the participants ranged between 20 and 90%, with mean ± SD = 67.4 ± 15.4%. Table 1 shows the distribution of the grades of adenoid obstruction observed using flexible nasopharyngoscopy. Figure 1 shows endoscopic picture of grade 1 and grade 3 adenoid obstruction.

The adenoid enlargement measured using ANR on plain radiograph ranged between 0.40 and 0.96, with mean ± SD = 0.7 ± 0.09. Table 2 shows the distribution of the degree of adenoid obstruction measured using the ANR method. Figure 2 shows X-ray postnasal space of mild and severe adenoid enlargement.

The findings of flexible nasopharyngoscopy and plain radiograph in the patients with obstructive adenoid disease were compared. The Pearson's correlation test revealed positive correlation between flexible nasopharyngoscopy and plain radiograph, and there was statistically significant correlation between the two investigation methods ($r = 0.858$, $P = .000$). Table 3 shows chi-square comparison between flexible nasopharyngoscopy and plain radiograph, and there was statistically significant association between the endoscopic and X-ray grading ($\chi^2 = 148.8$, $P = .000$).

**Table 1: Flexible nasopharyngoscopy grading**

| Endoscopic grading | Frequency | Percentage |
|---|---|---|
| Grade 1 | 25 | 17.9 |
| Grade 2 | 77 | 55.0 |
| Grade 3 | 38 | 27.1 |
| **Total** | **140** | **100** |

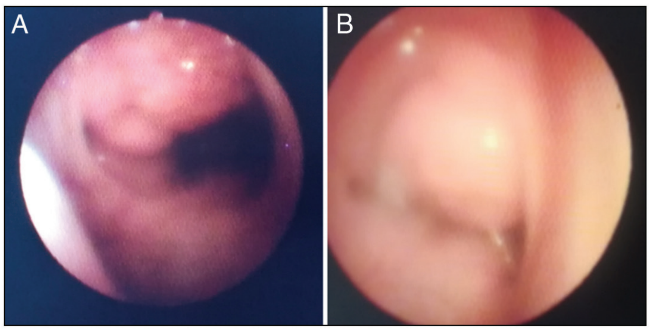


**Figure 1: Endoscopic picture of grade 1 (A) and grade 3 (B) adenoid obstruction**

**Table 2: Plain radiograph grading**

| X-ray grading | Frequency | Percentage |
|---|---|---|
| Mild obstruction | 29 | 20.7 |
| Moderate obstruction | 77 | 55.0 |
| Severe obstruction | 34 | 24.3 |
| **Total** | **140** | **100** |

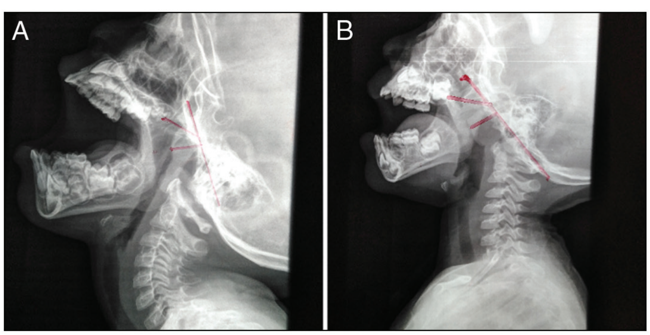


**Figure 2: X-ray postnasal space of mild (A) and severe (B) adenoid enlargement**

## Discussion

Flexible nasopharyngoscopy is nowadays an established method used in otolaryngology practice. The introduction of flexible nasopharyngoscopy made it possible to examine the nasal cavities, pharynx, and larynx in children with ease and permit accurate diagnosis to be made. The procedure is well tolerated in the paediatric age group and some authors considered it as the method of choice for the evaluation of the nasopharynx in children.[23-25] In this research, the flexible endoscopic grading and plain radiograph grading in the patients with obstructive adenoid disease were compared, and the findings showed a statistically significant association ($\chi^2 = 148.8$, $P = .000$). This is similar to the findings of other studies that reported a statistically significant association between the flexible endoscopy and plain radiograph for both small and large adenoids.[13,26] Additionally, the Pearson's correlation test revealed a strong positive correlation between flexible nasopharyngoscopy and plain radiograph in patients with obstructive adenoid disease studied ($r = 0.858$, $P = .000$). This is similar to the findings of Kindermann *et al.*[13] and Souki *et al.*[27] who reported a statistically significant agreement with correlation coefficient of $r = 0.83$ ($P < .001$) and $r = 0.67$ ($P < .05$), respectively. In contrast, Mlynarek *et al.*[28] reported a weak correlation of $r = 0.312$ ($P = .082$), whereas Wormald *et al.*[29] reported poor correlation with no statistically significant agreement between the two methods ($r = 0.11$, $P > .5$). These variations may be due to differences in the study protocol, age group, or sample size selected in their studies.

This study found severe adenoid obstruction (endoscopic grade 3) in 27.1% of the patients. This is lower than the findings obtained in a study in Texas, USA, where severe obstruction was seen in 59% of the patients.[30] The higher prevalence of severe obstruction in their study may be due to the nature of the participants they studied. The authors selected only children with obstructive sleep apnoea, and this group of patients are expected to have more severe form of adenoid obstruction. Endoscopic grade 2 adenoid hypertrophy was seen in 55% of the participants of this study; this is similar to the findings of Satish *et al.*[31] who reported that 50% of their patients had

**Table 3: Comparison of flexible nasopharyngoscopy and plain radiograph**

| Endoscopic grading | X-ray grading | | | Total | Chi-square | *P* value |
|---|---|---|---|---|---|---|
| | Mild | Moderate | Severe | | | |
| Grade 1 | 23 (92.0%) | 2 (8.0%) | 0 (0.0%) | 25 (100%) | | |
| Grade 2 | 6 (7.8%) | 64 (83.1%) | 7 (9.1%) | 77 (100%) | 148.8 | 0.000* |
| Grade 3 | 0 (0.0%) | 11 (28.9%) | 27 (71.1%) | 38 (100%) | | |
| **Total** | **29 (100%)** | **77 (100%)** | **34 (100%)** | **140 (100%)** | | |

*Statistically significant association

endoscopic grade 2 adenoid obstruction. The similarities of the findings may be attributed to similar endoscopic grading system with our study. In this study, grade 1 adenoid obstruction was observed in 17.9% of the patients; this is contrary to the findings of Isaac *et al.*[32] in Canada and Ameli *et al.*[33] in Italy where they reported higher proportion of endoscopic grade 1 adenoid enlargement (46% and 36.1%, respectively). The higher percentage of grade 1 adenoid hypertrophy in their studies may be due to the selection of older children (mean age of 10.3 and 6.7 years, respectively) compared to our study (mean age of 4.5 years). The older children tend to have milder form of obstructive adenoid disease.[24,34] This is because older children have wider nasopharyngeal airway space, and the adenoid enlargement was reported to start regressing after the age of 4.5 years.[22]

In summary, this study further supports the existing evidence of a strong correlation between flexible nasopharyngoscopy and plain radiograph in the diagnosis of obstructive adenoid disease. It is therefore recommended that flexible nasopharyngoscopy should be favoured (in centres where available) in the assessment of obstructive adenoid disease, as it gives the same result as an X-ray and at the same time avoids exposure to radiation. The strength of this study lies in the comparison of the two diagnostic methods in randomly selected patients. The patients underwent standard endoscopic and X-ray procedures, and the findings were interpreted based on standard measurements. However, one of the limitation encountered was difficulty in performing the procedure on an uncooperative child. This was minimised by explaining the procedure to an older child and by the application of topical anaesthetic spray to the nose, which reduced discomfort and improved cooperation. There is a need to carry out further studies on this topic, probably comparison of these two procedures in the assessment of pre- and post-operative nasopharyngeal airway space.

## Conclusion

This study found that flexible nasopharyngoscopy correlated very well with ANR measurements on plain radiograph of the postnasal space. Therefore, flexible nasopharyngoscopy is recommended for the assessment of obstructive adenoid disease as it avoids exposure to radiation.


### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.


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