ความสัมพันธ์ระหว่าง Adenoidal nasopharyngeal ratio (ANR) กับภาวะหยุดหายใจระหว่างหลับในเด็กที่มีภาวะต่อมอะดีนอยด์โต

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บทคัดย่อ

ภาวะต่อมอะดีนอยด์โตเป็นหนึ่งในปัญหาสุขภาพที่พบบ่อยในประชากรเด็ก การศึกษานี้มีจุดประสงค์เพื่อหาความสัมพันธ์ระหว่าง Adenoidal nasopharyngeal ratio (ANR) กับภาวะหยุดหายใจระหว่างหลับในเด็กที่มีภาวะต่อมอะดีนอยด์โตในโรงพยาบาลอุดรธานี ประเทศไทยการวิจัยนี้ทำการศึกษาย้อนหลังในข้อมูลผู้ป่วยเด็กที่มีอายุระหว่าง 2- 8 ปี ที่ได้รับการวินิจฉัยว่ามีภาวะต่อมอะดีนอยด์โตในประวัติการรักษาของโรงพยาบาลอุดรธานีตั้งแต่เดือน มกราคม พ.ศ. 2563 ถึงธันวาคม พ.ศ. 2563 โดยเก็บประวัติเกี่ยวกับอาการต่างๆ เช่น การกรน น้ำมูก คัดจมูก หายใจเสียงดัง หายใจทางปาก การง่วงนอนในช่วงกลางวันและภาวะการเจริญเติบโตถดถอย ร่วมกับการวัด Adenoidal nasopharyngeal ratio (ANR) จากเอกซเรย์ทั่วไปบริเวณ

อะดีนอยด์และแบ่งตามเกณฑ์ Adenoidal nasopharyngeal ratio (ANR) เป็นมีการอุดตันเล็กน้อย (ANR <0.7) การอุดตันปานกลาง (ANR 0.7-1.1) และการอุดตันมาก (ANR > 1.1) ใช้สถิติเชิงพรรณนาและ Chi-square test ในการวิเคราะห์ความสัมพันธ์

ผลการศึกษาผู้ป่วยเด็กอายุ 2-8 ปี จำนวน 131 คนเป็นเพศชาย 80 คน ร้อยละ 61.1 คิดเป็นสัดส่วน ชายต่อหญิงเป็น 1.56:1 อายุเฉลี่ย 4.8 ปี (S.D.=1.7) ในผู้ป่วยทุกคนพบอาการนอนกรน (snoring) ร้อยละ 100 ภาวะหยุดหายใจระหว่างหลับ (obstructive sleep apnea) ร้อยละ 61.1 มีน้ำมูก (nasal discharge) ร้อยละ 55.7 จากการวิเคราะห์ข้อมูลทางสถิติพบว่าไม่มีความสัมพันธ์อย่างมีนัยสำคัญระหว่างเพศ, อายุ และ ANR ที่แตกต่างกันกับภาวะหยุดหายใจระหว่างหลับ (p=0.494, p=0.116 และ p=0.352 ตามลำดับ)

สรุป เอกซเรย์ทั่วไปบริเวณอะดีนอยด์เป็นเครื่องมือที่มีประสิทธิภาพในการประเมินภาวะอะดีนอยด์โตโดยเฉพาะในประเทศที่มีทรัพยากรจำกัด เครื่องมือนี้สามารถให้ข้อมูลการวัดสัดส่วน (ANR ratio) เพื่อประเมินภาวะอะดีนอยด์โตได้อย่างเป็นรูปธรรมเพื่อเป็นประโยชน์ในการตัดสินใจผ่าตัด ถึงแม้ว่าในการศึกษานี้จะพบว่าไม่มีความสัมพันธ์อย่างมีนัยสำคัญระหว่างอายุ, เพศ, ANR ที่แตกต่างกันกับภาวะหยุดหายใจระหว่างหลับ

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Correlation between adenoidal nasopharyngeal ratio andobstructive sleep apnea in children with adenoidal hypertrophy

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Abstract

Adenoid hypertrophy is one of the most common health problems affecting the pediatric population. This retrospective study aimed to correlate adenoidal nasopharyngeal ratio (ANR) with obstructive sleep apnea in children with adenoidal hypertrophy at Udon Thani hospital, Thailand. Adenoidal Nasopharyngeal Ratio (ANR) was determined by dividing adenoidal depth with nasopharyngeal depth on the Lateral X-ray of the nasopharynx, devided to 3 groups : mild obstruction (ANR < 0.7), moderate obstruction (ANR 0.7-1.1) and severe obstruction (ANR > 1.1). Descriptive statistic and Chi-square test had used for analyse correlations.

Results: Total of 131 children, 2-8 years old, who diagnosed adenotonsillar hypertrophy were recruited for the study. Male were 80 (61.1%) with male: female ratio was 1.56:1. The mean age was 4.8 years old (S.D.=1.7) with age group 2-5 years old was the most affected group (64.1%). All the patients presented with snoring (100%). 61.1% had sleep apnea and 55.7% had nasaldischarge. Nosignificant association between sex, age, ANR and obstructive sleep apnea (p=0.494, p=0.116and, p=0.352, respectively).

Conclusion: Lateral X-ray of the nasopharynx is an effective tool to evaluate children with suspected adenoid hypertrophy, especially in a resource-limited environment. It provides objective measures of adenoid hypertrophy from ANR ratio as well as useful information that may help to decide the need for surgery. Although in this study shows no significant association between the age, sex, ANR and obstructive sleep apnea.

Keywords: Nasopharyngeal ratio, obstructive sleep apnea, adenoidal hypertrophy

INTRODUCTION

Adenoids constitute the upper portion of the Waldeyer's ring at the portal of the upper respiratory tract.[1-2] It is an important site of contact of inhaled microorganisms and antigens with immunoactive cells.[1] Adenoids grow more rapidly than the bony structure of the nasopharynx in children predisposing them to obstructive symptoms.[3] The clinical symptoms of obstructive adenoids are more common in the younger age due to the relatively small volume of the nasopharynx and the increased frequency of upper respiratory infections.[4]

The incidence of obstructive sleep apnea in children is estimated to be 2-3%[5], whereas primary snoring is more common and is estimated to occur in 6-9% of children.[5] The peak incidence of obstructive sleep apnea occurs between 2 to 8 year of age[5] and parallels the prominent growth of lymphoid tissue around the airway during these years. Adenoid hypertrophy plays an important role in various pathological manifestations, which include otitis media with effusion/recurrent otitis, rhinosinusitis, adenoiditis and obstructive sleep apnea.[1] Other problems reported to have resulted from enlarged adenoids that include failure to thrive, excessive daytime sleepiness, impairment of cognitive functions, poor school performance and psychosocial problems.[5]

The clinical spectrum of obstructive sleep apnea in children ranges from snoring with mild and partial upper airway obstruction to complete of airflow with gas exchange abnormalities and severe disturbance of sleep. Obstructive sleep apnea in children may result in severe complication if still untreated. The most common are growth failure, pulmonary hypertension and neurocognitive deficit such as hyperactivity, inattentiveness, and poor academic performance.[5] Interestingly, many of these symptoms, and particularly academic performance, have been shown to be reversible once obstructive sleep apnea has been treated in these children.[6-7]

Although adenoidectomy continues to be one of the most common surgical procedure performed in the pediatric population. There has been an emphysis on the careful selection of subjects for the surgical procedure due to consensus on the immunological role played by adenoids as well as the potential complications of the surgery.[2,4-5,8] Clinical symptoms, lateral X-ray of the nasopharynx and endoscopy had been performed as preoperative methods for evaluating adenoid size, there had been no universal guidelines for assessing adenoidal enlargement and no clear cut accepted indications for adenoidectomy.[9-10] Diagnosis and documentation of adenoidal hypertrophy, however, become an important issue when adenoidectomy is been considered.[10-11] Objective measures of adenoid hypertrophy are useful to provide information that may help deciding the need of surgery and subsequently outcomes' evaluation.

Therefore, adequate preoperative evaluation which includes physical examination, nasopharyngolaryngoscopy, plain radiograph, rhinomanometry, computerized tomography scan and magnetic resonance imaging are necessary for careful and accurate selection of patients for surgeries.[3,11]

Different these methodsas mentioned for assessing adenoidal enlargement have been described in literature as regards the evaluation of adenoids on lateral nasopharyngeal radiographs.[9,12-15] So in Nigeria and other less developed countries, advance imaging modalities are not readily available and cost are expensive. Lateral

X-ray of the nasopharynxis low cost, prompt available and comfortable for the child with a simple way of determining adenoids' size, shape, and position.[2,16] Thailand and Udon Thani hospital also use lateral X-ray of the nasopharynx to evaluated adenoidal size for economical reason. Adenoidal nasopharyngeal ratio: ANR) using the method of Fujioka[17] which measured the ANR on lateral X-ray of the nasopharynx [Figure 1]. An ANR >0.67 was considered to indicate adenoidal hypertrophy.[17]

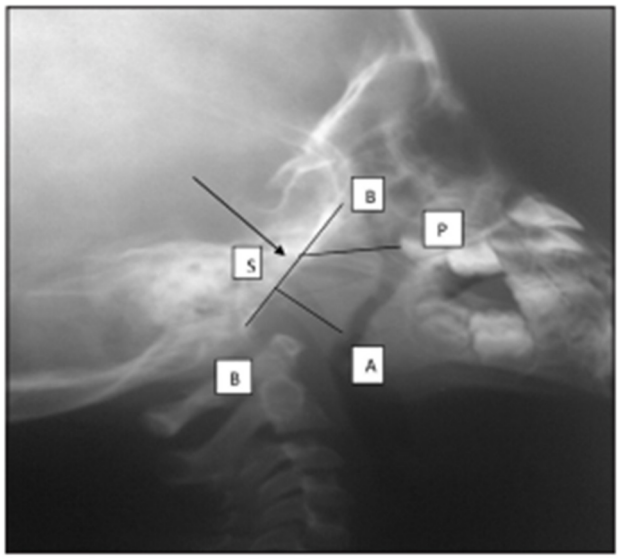


Figure 1: Lateral X-ray of the nasopharynx that shows how adenoidal-nasopharyngeal ratio was determined.

A: Adenoid depth measured along the line drawn perpendicular from the point of maximal convexity along the inferior margin of the adenoidal shadow to its point of intersection with line B.

B: Line drawn along straight part of anterior margin of basiocciput.

S: Sphenobasioccipital synchondrosis.

P:line form anterior inferior edge of S to posterior superior margin of hard palate.

ANR: Adenoidal nasopharyngeal ratio is obtained by dividing A by P.

Objective

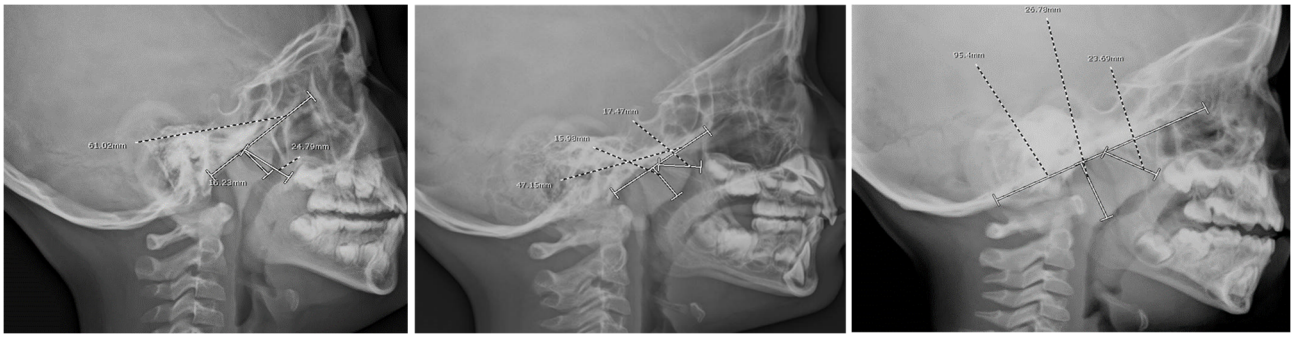
This study aimed to use adenoidal naso-pharyngeal ratio (ANR) correlate with obstructive sleep apnea in children with adenoidal hypertrophy. This should made the reliability of assessment due to objective measures of adenoid hypertrophy to predict the severity of nasopharyngeal obstruction.

Materials and Methods

This retrospective study was approved by The Research Ethics Committee of Udon Than hospital. Sample included patients age 2-8 years old who diagnosed adenotonsillar hypertrophy (ICD-10 J353) during January 2020 - December 2020 were eligible for inclusion criteria in this research. Retrospectively review collected data from outpatient medical record for patients' demographic and clinical information about obstructive sleep apnea symptoms such as the presence of snoring, nasal discharge, nasal obstruction, noisy sleep, mouth breathing, daytime sleepiness and failure to thrive. Each symptom was rated on a scale (absent=0, present=1).

The lateral X-ray of the nasopharynx were obtained in patient with snoring and suspected obstructive sleep apnea which prescribed by pediatricians or otolaryngologist doctors. As the standard of lateral soft tissue technique, the beam was centered to the external auditory meatus with the head in true lateral position and the patient breathing through the nose with the mouth closed. The dimension of the adenoids and nasopharynx were measured with a transparent rule using the standard landmarks designed by Fujioka[17] [Figure 1]. Adenoid depth was determined by drawing a perpendicular line from a line drawn along the straight part of the anterior margin of basiocciput to a point of maximal convexity of adenoid. Nasopharyngeal depth was determined

by drawing a line from the anterior inferior edge of sphenobasioccipital synchondrosis to the posterior superior margin of the hard palate. Adenoidal nasopharyngeal ratio (ANR) was obtained by dividing adenoid depth by naso-pharyngeal depth, ANR >0.67 was considered to indicate adenoidal hypertrophy.[17] This study used an adenoidal-nasopharyngeal ratio parameter to classify roentgenographic assessment into mildobstruction (ANR <0.7), moderate obstruction (ANR 0.7-1.1) or severe obstruction (ANR >1.1) [Figure 2]



A: Mild obstruction ANR <0.7 B: Moderate obstruction ANR 0.7-1.1 C: Severe obstruction ANR > 1.1

Figure 2. Shown ANR related to degree of nasopharyngeal obstruction. A: Mild obstruction (ANR <0.7), B: Moderate obstruction (ANR 0.7-1.1), C: Severe obstruction (ANR >1.1)

The data were presented in simple descriptive forms as proportions using tables and graphic charts. Analysis was used to determine the degree of association between age and obstructive sleep apnea and between various adenoids symptoms and obstructive sleep apnea. Chi-square was used to determine the differences between ANR and the obstructive sleep apnea. The level of significant was set at 0.05.

Ethic consideration

This research was approved by the Human Subjects Ethics and Research Committee, Udon Thani hospital, UDH REC no.7/2565 approved date 17 Feb 2022. There was no commercial fund support, and the author declared no conflict of interest.

Results

Total of 131children, age 2-8 years old, who diagnosed adenotonsillar hypertrophy were recruited for the study. Male were 80 (61.1%) with male: female ratio of 1.56:1. The mean age was 4.8 years old (S.D.=1.7) with age group 2-5 years old was the most affected group (64.1%). All the patients presented with snoring (100%), other symptoms were sleep apnea (61.1%), nasal discharge (55.7%) with nasal obstruction (32.8%) and noisy breath (31.2%). ANR was determined from plain lateral radiograph of the post nasal space. ANR ranges from 0.4 to 1.4 (mean= 0.7, SD=0.2). Most of them (49.6%) had moderate nasopharyngeal obstructions, 45.0% had mild obstructions. [Table 1]

Table 1: Gender, age, symptoms and degree of nasopharyngeal obstruction in sample group. (N=131)

Factors	n (%)
Gender	
Male	80 (61.1)
female	51(38.9)
Age (years old)	
2-5	84(64.1)
6-8	47(35.9)
Mean =4.8 (S.D. =1.7), range 2-8	
Symptoms	
Snoring	131 (100)
Sleep apnea	80 (61.1)
Nasal discharge	73 (55.7)
Nasal obstruction	43 (32.8)
Noisy breath	41 (31.2)
Mouth breath	15 (11.5)
Excess daytime	2 (1.5)
Failure to thrive	0 (0)
Degree of nasopharyngeal obstruction (ANR)	
Mild obstruction ANR < 0.7	59 (45.0)
Moderate obstruction ANR 0.7-1.1	65 (49.6)
Severe obstruction ANR > 1.1	7(5.4)
Mean= 0.7 (S.D.= 0.2), range 0.4-1.4	

Preponderance of sleep apnea (70.0%) was found among children 2-5 years old, followed by 6-8 years old (30.0%). Other frequent associated symptoms are found in this study, most common is bedwetting 22 (16.9%), obesity 18 (13.7%), sinusitis 13 (9.9%) and asthma 12 (9.1%).There was no significant correlation between factors studied and obstructive sleep apnea. Separation analysis showed no significant association between sex and obstructive sleep apnea (c^2 =0.467, p=0.494), between age and obstructive sleep apnea (c^2=2.465, P=0.116), and also between ANR and obstructive sleep apnea (c^2=2.088, p=0.352). [Table 2]

Table 2: Correlation of gender, age, ANR and obstructive sleep apnea (OSA) (N=131)

Factors	n	OSA		Chi-square	p-value
		มี n=80 n (%)	ไม่มี n=51 n (%)		
Gender				0.467	0.494
Male	80	47 (58.8)	33 (64.7)		
Female	51	33 (41.2)	18 (35.3)		
Age (years old)				2.465	0.116
2-5	84	56 (70.0)	28 (54.9)		
6-8	47	24 (30.0)	23 (45.1)		
Adenonasopharyngeal ratio (ANR)				2.088	0.352
Mild obstruction, ANR <0.7	59	34 (42.5)	25 (49.0)		
Moderate obstruction, ANR 0.7-1.1	65	40 (50.0)	25 (49.0)		
Severe obstruction, ANR > 1.1	7	6 (7.5)	1 (2.0)		

Discussion

The mean age of this study was 4.8 years old (S.D.=1.7) with preponderance of the disease among age group 2-5 years old was similar to the reports of previous study.[4,11] This was due to the fact that adenoid has relatively higher growth rate than the nasopharynx between the ages of 2 and 5 years.[4,11] Male predominance had seen in this study, same as previous report.[11]

The method employed in this study was the same with the method used by most of the previous studies.[9,11-12,16] ANR had been found to reflect both the adenoidal size and nasopharyngeal capacity.[11,16] The degree of nasopharyngeal airway obstruction as obtained from ANR has been shown to be a more reliable parameter than the actual size or volume of resected adenoids in the evaluation of adenoidal obstruction severity.[6-7,11] In Nigeria reported a high level of agreement among trained interraters (Otolaryngologists and Radiologists), in subjectively interpreting lateral X-ray of nasopharynx in children with suspected adenoidal obstruction.[15]

The findings of moderate obstruction (ANR 0.7-1.1) and severe obstruction (ANR >1.1) in larger proportion of the patients in this study similar to the findings of other researchers.[11-12] This may be due to parents of these children would have been consulting pediatricians/family physicians first, who had poor responsive to medical management or cases with moderate/ severe obstruction would be seen by the otolaryngologists. The rate of growth of adenoid tissues is at its peak at ages 2-5 years old.[4,11] Increased frequency of upper respiratory tracts infection at 2-5 years old group and relatively small volume of the nasopharynx at this younger age make clinical symptoms to be more common during this period.[1]

Lateral X-ray of the nasopharynx are generally available, accessible and non-invasive. This has made it an invaluable tool in many developing countries. Primary caregivers such as pediatricians and family physicians should have adequate knowledge about lateral X-ray of the nasopharynx for early diagnosis and provide appropriate referral to otorhinolaryngologist for prompt and appropriate intervention before sequelae develop. Some of the limitations of the assessment of the lateral X-ray of the nasopharynx might be due to the difficulty in the standardization of the degree of obstruction. Therefore, in this study had objective measures of the adenoidal hypertrophy for provide useful information that may help deciding the need of surgery as well as for outcomes evaluation.

ANR and more common specific symptoms in patients with adenoid hypertrophy in this study makes lateral X-ray of nasopharynx for evaluation of adenoid enlargement a relevant and reliable tool can provide useful information on the degree of nasopharyngeal obstruction.[16] Mlynarek et al[9] had reported lateral X-ray of nasopharynx to have relevance in establishing diagnosis and planning treatment in adenoidal enlargement.[9] In Kurien et al[13] study, lateral X-rays of nasopharynx in the evaluation of adenoid hypertrophy reported statistically significant correlation in 65% of the patients between the X-ray and endoscopy findings and concluded that lateral X-rays of the nasopharynx, besides being a non-invasive procedure, still remains a very reliable and valid diagnostic test in the evaluation of hypertrophied adenoids. Orji and Ezeanolue[11] studied found a strong correlation between the symptoms of adenoidal obstruction and X-ray of nasopharyngeal airway obstruction. They concluded that graded assessment of

adenoidal obstruction symptomatology is comparable to roentgenographic assessment in evaluating the severity, especially at the level of extreme of gross obstruction and minimal obstruction.[11]

The limitations and some disadvantages associated with X-ray were noted. Risk associated with the irradiation of the child, however, limited resources had made lateral X-ray of the nasopharynx in the airway management of patients with adenoidal hypertrophy a relevant and indispensable tool.

Conclusion

Lateral X-ray of the nasopharynx is a useful objective tool to evaluate children with suspected adenoid hypertrophy, especially in a resource-limited environment. It provides objective measures of adenoid hypertrophy as well as useful information that may help to decide the need for surgery. Although in this study shows no significant association between the age, sex, ANR and obstructive sleep apnea.

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