

Research**Diagnostic of lingual tonsil hypertrophy with lateral soft tissue cervical X-ray on laryngopharyngeal reflux**

Ade Asyari*, Novialdi*, Bonny Murizky*, Wahyu Julianda*,
Esmaralda Nurul Amany*, Tuti Handayani**, Hafni Bachtiar***

*Department of Oto Rhino Laryngology-Head and Neck Surgery,

**Department of Radiology

*** Department of Public Health

Dr. M. Djamil Hospital, Padang

ABSTRACT

Background: Lingual tonsil hypertrophy (LTH) evaluation could be performed by flexible fiberoptic laryngoscopy, lateral soft tissue cervical X-ray, CT scan, and magnetic resonance imaging (MRI). Lateral soft tissue cervical X-ray examination is considered as a procedure-of-choice for diagnostic testing of LTH, which, aside from being low cost, the examination could also be conducted in all hospitals and easy to be performed on children. **Objective:** To compare the lingual tonsil enlargement with examination procedure using lateral soft tissue cervical X-ray as an LTH diagnostic measure compared to the flexible fiberoptic laryngoscopy examination as the gold standard examination. **Methods:** A retrospective analytic study with cross-sectional design on 30 respondents of laryngopharyngeal reflux (LPR) patients who came for routine ENT physical examination, followed by flexible fiberoptic laryngoscopy examination along with lateral soft tissue cervical X-ray. **Results:** The sensitivity level of 65.38% was acquired from the statistical tests, along with specificity level of 100%, positive predictive value (PPV) of 100%, and negative predictive value (NPV) of 30.37%. **Conclusion:** Based on sensitivity and specificity, lateral soft tissue cervical X-ray examination could be used as a diagnostic measure and have an accurate capability to diagnose LTH.

Keywords: lingual tonsil hypertrophy, laryngopharyngeal reflux, flexible fiberoptic laryngoscopy, lateral soft tissue cervical X-ray

ABSTRAK

Latar belakang: Evaluasi hipertrofi tonsil lingual (HTL) dapat dilakukan menggunakan laringoskopi serat optik fleksibel, foto Rontgen cervical soft tissue lateral, CT scan, dan magnetic resonance imaging (MRI). Foto Rontgen cervical soft tissue lateral dapat dipertimbangkan sebagai pilihan pemeriksaan diagnostik HTL, karena selain biayanya terjangkau, pemeriksaan ini dapat dilakukan di semua rumah sakit serta mudah dilakukan pada pasien anak. **Tujuan:** Membandingkan hasil pemeriksaan pembesaran tonsil lingual menggunakan foto Rontgen cervical soft tissue lateral dengan pemeriksaan laringoskopi serat optik fleksibel sebagai pemeriksaan baku emas. **Metode:** Penelitian analitik retrospektif dengan desain potong lintang pada 30 pasien laryngopharyngeal reflux (LPR) yang dilakukan pemeriksaan fisik THH rutin, diikuti dengan pemeriksaan laringoskopi serat optik fleksibel serta foto Rontgen cervical soft tissue lateral. **Hasil:** Didapatkan tingkat sensitivitas dari uji statistik sebesar 65,38%, dengan tingkat spesitivitas sebesar 100%, dan didapatkan nilai prediksi positif (NPP) sebesar 100% serta nilai prediksi negatif (NPN) sebesar 30,37%. **Kesimpulan:** Berdasarkan sensitivitas dan spesifisitas, foto Rontgen cervical soft tissue lateral dapat digunakan sebagai alat diagnostik dan memiliki kemampuan yang akurat dalam diagnosis HTL.

Kata kunci: hipertrofi tonsil lingual, laryngopharyngeal reflux, laringoskopi serat optik fleksibel, foto Rontgen cervical soft tissue lateral

Correspondence address: Ade Asyari, Department of Oto Rhino Laryngology-Head and Neck Surgery, Medical Faculty Andalas University / Dr. M. Djamil General Hospital Padang. Email: adeasyari2@gmail.com.

INTRODUCTION

Lingual tonsil is a collection of lymphatic tissue located at the base of the tongue, supported by a thin layer of fibrous tissue. Enlargement of the lingual tonsil has several clinical implications such as dysphagia, upper airway obstruction, difficulty in intubation or gastrointestinal endoscopy.¹⁻³

Lingual tonsil hypertrophy (LTH) could be the result of edema, inflammation, and hyperplasia of tissue due to repeated exposure of tonsil mucosa towards reflux of gastric acid causing thickening and inflammation of mucosa which could constrict the airway in the retrolingual area, therefore increasing the likelihood of airway obstruction.^{2,4,5} Several causes could trigger LTH include post-tonsillectomy reactive lymphoid hyperplasia, laryngopharyngeal reflux (LPR), obesity, infection, environmental allergies, malignancy, smoke exposure, tobacco, and usage of drugs such as phenytoin.^{2,3,6}

Laryngopharyngeal reflux (LPR) occurs due to retrograde flow of gastric acid to the esophagus, up to larynx-pharynx structures. Acidic contents from gastric reflux could irritate and damage structures of the tissue around the larynx.^{7,8} Presumably, there is a strong association and interplay between LPR as a potential cause of LTH up to the occurrence of obstructive sleep apnea (OSA).³

Study by Sung et al. quoted by Harris³ explained, on 102 sample patients, an association was found between LTH and evidences of reflux from endoscopic examination, OSA and obesity along with an association with body mass index (BMI) approximately 28.2%, with LPR and OSA approximately 20%.³ Sung also conducted assessments towards enlargement of lingual tonsil with a grading system

comparing between lateral soft tissue cervical X-ray examination and flexible fiberoptic laryngoscopy examination, based on lingual tonsil size and its visualization from the vallecula.² Friedman et al.¹ had also conducted a grading system based on flexible fiberoptic laryngoscopy examination and computed tomography (CT) scan on lingual tonsil to perform standardization on assessment towards LTH enlargement using a grading system on the lingual tonsil.

Evaluation of the LTH could be performed by flexible fiberoptic laryngoscopy, lateral soft tissue cervical X-ray, CT scan, and magnetic resonance imaging (MRI).² LTH evaluation by flexible fiberoptic laryngoscopy and MRI or CT scan imaging have shortcomings such as instruments that need to be cleaned each time after every use, thus it could take time, instrument maintenance, expensive examination cost, unavailability of such instruments at many hospitals, and patient cooperation during examination. For such reasons, it was considered to find alternative examinations for diagnostic testing of LTH, using lateral soft tissue cervical X-ray, which, aside from being cheaper, the examination could also be conducted in all hospitals.⁹ Lateral soft tissue cervical X-ray examination is also easy to be performed on children, approximately 83% if compared to CT scan examination.¹⁰

Flexible fiberoptic laryngoscopy as the gold standard examination of larynx is not always available in all hospitals, and the high cost of the examination inspires the researchers to conduct a comparison of lateral soft tissue cervical X-ray examination with flexible fiberoptic laryngoscopy examination on patients of LPR with LTH, with expectation that it could be used as a reference for assessment and diagnostic support. The

researchers believe that the X-ray examination could be useful in providing an overall view towards LTH manifestations, therefore, an LTH diagnosis could be made based on radiological examination. Such research had never been conducted in Padang, especially in the ENT-HNS Department of Medical Faculty of Andalas University / Dr. M. Djamil Hospital Padang.

METHOD

This was a retrospective analytic study with cross-sectional design, conducted in Dr. M. Djamil Hospital, Padang, with collection of subjects from September 2018 until the number of required samples was met.

Patient population comprised of LPR patients who came to Dr. M. Djamil Hospital Padang, including those with and without prior treatment. Sampling was conducted by consecutive sampling method with inclusion criteria of willingness to participate in the study along with signing an informed consent, and being over 18 years of age. The exclusion criterion was patients with suspected hypopharyngeal malignancy.

History taking and routine ENT physical examination were conducted on patients being treated at the ENT-HNS Polyclinic of Dr. M. Djamil Hospital Padang, followed by a flexible fiberoptic naso-laryngoscopic examination, starting from the nasal cavity

to the nasopharynx, with the optic fiber bent downward, thus allowing visualization of the base of the tongue, to assess whether there was an enlargement of the lingual tonsil. Then, a lateral soft tissue cervical X-ray was performed at the Radiology Department. The results of lateral soft tissue cervical X-ray were interpreted by radiologists at Dr. M. Djamil Hospital Padang.

RESULT

This study was conducted on LPR patients, including those with and without prior treatment. There were 30 respondents which met the inclusion criteria and agreed to participate in the study. On all respondents, history taking and routine ENT physical examination was conducted, followed by flexible fiberoptic laryngoscopy examination at the Integrated Diagnostic Unit along with lateral soft tissue cervical X-ray at the Radiology Department by one radiographer and results were interpreted by radiologists to diagnose lingual tonsil hypertrophy.

According to Table 1, the mean age of respondents was 49.20 ± 10.95 years old, and based on sex, female were dominant with a total of 23 samples (76.7%), the highest number of respondents' education level was university-level 43.3%, and the highest respondents' occupations were government employees and housewives, both at 43.3%.

Table 1. Characteristics of respondents

Variable	Frequency	Percentage
Mean of age 49.20 ± 10.95 years		
Sex		
Male	7	23.30
Female	23	76.70
Education level		
Elementary school	3	10.00
Middle school	2	6.70
High school	12	40.00
University	13	43.30
Occupation		
Farmer	2	6.70
Government employee	13	43.30
Housewife	13	43.30
Private sector	2	6.70

In this study, the most common symptom was sensation of lump in the throat, found in 27 respondents (90%), other common symptoms include fatigue and hoarseness found in 24

respondents (80%) (Table 2). Mean RSI score of respondents was 18.53 ± 6.93 and mean RFS score was 8.00 ± 1.78 .

Table 2. Distribution of respondents based on symptoms

Symptoms	f	Percentage
Sensation of lump in the throat	27	90.00
Fatigue	24	80.00
Hoarseness	24	80.00
History of gastritis	23	76.70
Mucus flow down the throat	19	63.30
Burning sensation in the chest	16	53.30
Cough while eating or sleeping	14	46.70
Snoring	13	43.30
Shortness of breath while sleeping	9	30.00

Among 30 patients in this study, the distribution of lingual tonsil enlargement in flexible fiberoptic laryngoscopy examination, 26 respondents (86.7%) were found with enlargement of lingual tonsil and 4 respondents (13.3%) were found with no enlargement of

lingual tonsil (Table 3). Meanwhile, the distribution of lingual tonsil enlargement in lateral soft tissue cervical X-ray examination, 17 respondents (56.7%) were seen to be enlarged, 13 respondents (43.3%) were not seen to be enlarged (Table 4).

Table 3. Distribution of lingual tonsil enlargement by flexible fiberoptic

Enlargement	f	Percentage
Enlarged	26	86.70
Not enlarged	4	13.30
Total	30	100.00

Table 4. Distribution of lingual tonsil enlargement in lateral soft tissue X-ray

Enlargement	f	Percentage
Detected	17	56.70
Undetected	13	43.30
Total	30	100.00

Statistical analysis results of this study were shown in the form of a 2x2 table. Statistical analysis and tests acquired these following results:

Sensitivity: $a / (a+c) = 17/26 \times 100\% = 65.38\%$

Specificity: $d / (b+d) = 4/4 \times 100\% = 100\%$

Positive Predictive Value: $a / (a+b) = 17/17 \times 100\% = 100\%$

Negative Predictive Value: $d / (c+d) = 4/13 \times 100\% = 30.37\%$

According to Table 4, a sensitivity level of 65.38% was acquired from the statistical tests, along with specificity level of 100%, positive predictive value (PPV) of 100%, and negative predictive value (NPV) of 30.37%.

Table 5. Sample distribution in lateral soft tissue cervical X-ray examination compared to fiberoptic laryngoscopy examination in LPR patients with lingual tonsil hypertrophy

	Laryngoscopy	Positive	Negative	Total
X-ray				
Positive		17	0	17
Negative		9	4	13
Total		26	4	30

DISCUSSION

This study was conducted to compare the lingual tonsil enlargement by examination procedure using lateral soft tissue cervical X-ray as an HTL diagnostic measure that is easily performed in all hospitals, compared to the flexible fiberoptic laryngoscopy examination as the gold standard examination. This was a retrospective analytic study with cross-sectional design to determine the sensitivity, specificity, positive predictive value, and negative predictive value in lateral soft tissue cervical X-ray examination compared to flexible fiberoptic laryngoscopy.

Based on sex characteristics in this study, LPR patients were dominantly female, with a number of 23 respondents (76.7%) compared to 7 male respondents (23.3%). This findings corresponded to the study by Andriani et al.¹¹ which found that LPR patients were mostly found in female respondents as many as 62.75%, also study by Asyari et al.¹² which found as many as 76.7%, and Sarkar et al.¹³ which found as many as 68.2%. This was caused by hormonal factors. Decrease of estrogen and progesterone hormone levels could alter the mucin acid levels in the digestive tract. Mucin serves as a protective wall against physical and enzymatic damage towards mucosa. Digestive symptoms could occur due to variations of mucin levels in mucosa, which is directly associated with variations in estrogen and progesterone levels.¹⁴ Hormonal factors also play a role in the increase of gastric acid secretion, where this factor directly stimulates parietal cells and peptic glands, hormonal pathway originates

from the hypothalamus to the anterior pituitary gland and adreno-corticotrophic hormone (ACTH) and stimulates the adrenal glands to produce cortisone and adrenaline which causes stimulation of parietal cells and peptic glands to produce HCl and pepsin.¹¹ Thus, LPR could occur or become aggravated during hormonal fluctuations in perimenopausal and menopausal periods.¹⁴

Based on sex characteristics in this study, LTH was mostly found in females, as many as 19 respondents (63.33%) and in males as many as 7 respondents (23.33%). This was in the contrary with the results of the study by Hwang et al.¹⁵ which, from 380 respondents, found 227 (59.74%) male respondents and 153 (40.26%) female respondents. Hwang et al.¹⁵ in their study stated that sex is one of the factors that could predict the increase of BMI which could cause LTH and associations between LPR, BMI as the factor of LTH occurrence. Sung et al. which was quoted by Harris³ also disclosed the same statement.

The mean age of LPR respondents in this study was 49.20 years of age with a standard deviation of 10.95 years. This study corresponded with the results of the study by Andriani et al.¹¹ with the age group of 41-50 years as many as 54.9% and Asyari et al.¹² which found that 40% were in the 48-57 years of age group. Changes in laryngeal mucosa commonly occur in 40 years of age or older because, in females entering the menopausal age, superficial layer edema causes a decrease of laryngeal mucus production, changes also occur in the epithelial mucosa of the plica vocalis so that the mucous epithelium is

thinning and the larynx is susceptible of being exposed to acidic substances which increases the occurrence of LPR. Furthermore, there are also changes in the supralaryngeal area in the forms of atrophy in pharyngeal, facial, and mastication muscles, accompanied by weakness in the esophageal sphincter muscles, which therefore facilitating the occurrence of LPR.^{11,12} This is associated with the occurrence of LTH, which is caused by LPR inducing edema, inflammation, and hyperplasia in the tissues due to repeated exposure of the tonsil mucosa to reflux of gastric acid causing inflammation and thickening in the mucosa which could restrict the airway in the retrolingual area and could increase the possibility of upper airway obstruction and OSA.^{4,5}

In this study, the symptom most commonly found was the sensation of a lump in the throat, found in 27 respondents (90%). This result was in accordance with Andriani et al.¹¹ which found a result of 96% respondents with sensation of a lump in the throat as the most common symptom found. Sensation of a lump in the throat could occur due to many factors, such as LPR which caused edema, inflammation, and hyperplasia of the lymphoid tissues at the base of the tongue as a result of repeated exposure of the lingual tonsil mucosa to reflux of gastric acid, thus causing thickening and inflammation in mucosa in the laryngeal area and the base of the tongue, causing LTH.^{4,5} In this study, 3 respondents were found with symptom of sensation of lump in the throat without occurrence of LTH. The sensation could occur due to psychological factors which could cause LPR-like symptoms without LTH. Administration of LPR therapy in these patients was not effective to relieve the patients' symptoms, therefore psychological factors should be suspected as the cause.¹⁶

Sung et al.² in their study stated that LTH was not found in adult patients without LPR or OSA, while lingual tonsil were found to

be enlarged in patients with LPR or OSA compared to patients without these diseases. They also found an association between LPR and LTH, which if not treated properly, could cause OSA and endanger the patients. Friedman et al.¹ also found the same results with an association between LPR and LTH which could eventually cause complications such as OSA.

The second most common symptom due to LTH was fatigue which was found in 24 respondents (80%), while another symptom related to LTH was snoring which was found in 13 respondents (43.3%). LTH may cause obstructive sleep apnea (OSA) and also may lead to a life-threatening obstruction of the upper airway.⁴ Sleepiness, fatigue, tiredness, or lack of energy was the that most frequent complaints of OSA patients.¹⁷

Distribution of LTH respondents in this study was based on the result of flexible fiberoptic laryngoscopy examinations as many as 26 respondents (86.7%). Study by Harris et al.³ found LTH in 20% of respondents. This study also found no enlargement of lingual tonsil in 4 respondents (13.3%). In lateral soft tissue cervical X-ray examination, 17 respondents (56.7%) were seen with enlarged lingual tonsil and 13 respondents (43.3%) were not enlarged.

Based on statistical analysis from 30 respondents who underwent lateral soft tissue cervical X-ray examination compared to the flexible fiberoptic laryngoscopy examination as the gold standard, a diagnostic test sensitivity of 65.38% was found. The diagnostic test specificity acquired by this study was 100%, which meant that the capability of lateral soft tissue cervical X-ray is very high in confirming LTH diagnosis, meaning that if a subject was not found with LTH in this examination, then this subject could already be confirmed as did not have LTH. Positive predictive value in this study was 100%, which meant that results of lateral soft tissue cervical X-ray photo produced very

good results to individuals being diagnosed as LTH. Meanwhile, negative predictive value in this study was 30.37%, which meant that there was still a possibility of a subject with LTH to be unidentified. With a diagnostic test sensitivity of 65.38% and specificity of 100%, LTH could definitely be diagnosed with lateral soft tissue cervical X-ray.

Sung et al.² also detected LTH by means of lateral soft tissue cervical X-ray, but the respondents were taken from patients already diagnosed as LTH, while in this study the respondents were LPR patients who were diagnosed as LTH from flexible fiberoptic laryngoscopy and underwent lateral soft tissue cervical X-ray, therefore there was quite a significant difference. Sedaghat et al.⁹ in their study to assess the enlargement of lingual tonsil by using lateral soft tissue cervical X-ray found 34% respondents detected with LTH in pediatric patients with Down syndrome.

Based on this study, it could be concluded that the sensitivity and specificity of lateral soft tissue cervical X-ray examination could definitely be used as a diagnostic measure, and had an accurate capability to diagnose LTH. Furthermore, the positive predictive value in this study gave very good results for individuals being diagnosed with LTH. Meanwhile, the negative predictive value in this study showed that there was still a possibility of a subject for not being diagnosed as LTH.

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