Photographic Objective Alterations for Laryngopharyngeal Reflux Diagnosis

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Summary: Objective. Diagnosis of laryngopharyngeal reflux (LPR) in clinical practice is generally made subjectively based on history, symptoms, and endoscopic assessment. This study presents the diagnostic role of the digital photographic assessment of the laryngopharyngeal region for LPR.

Methods. Seventy-two patients with LPR symptoms and 35 healthy volunteers were evaluated using the Reflux Finding Scores (RFS) and the Reflux Symptom Index (RSI). The results of these scales were recorded in 72 patients representing group 1 with LPR diagnosis; they returned after 1 and 2 months of treatment as groups 2 and 3, respectively. Thirty-five volunteers represented group 4. Laryngopharyngeal regions of all subjects were examined and photographed endoscopically. Red, green, and blue (RGB) values of particular oropharyngeal and laryngeal points were measured.

Results. RSI and RFS values of group 1 were significantly different from the other three groups, as were the scores of group 2; however, the comparison of the RSI and RFS values of groups 3 and 4 did not reveal a statistically significant difference. Laryngopharyngeal RGB values also duplicated statistical significance as above.

Conclusion. Measurement of RGB values can be a cheap and easy-to-use method to quickly provide objective and corroborative information to help in the diagnosis of LPR in conjunction with subjective methods.

Key Words: Diagnosis–Laryngopharyngeal reflux–Objective–RGB.

INTRODUCTION

Gastroesophageal reflux is the backflow of gastric contents up to the esophagus without vomiting or retching.[1] Laryngopharyngeal reflux (LPR) is an advanced stage of gastroesophageal reflux where the backflow is so strong that the gastric contents pass through the upper esophageal sphincter and actually enter the laryngopharyngeal regions.[2] LPR can lead to various ailments such as ulcers in the oral cavity, gingivitis, caries and tooth malformations, ulcerative lesions of the oral mucosa, chronic rhinosinusitis, asthma, chronic interstitial pulmonary diseases, and sudden infant death.[3] LPR is also associated with various otolaryngological pathologies and symptoms like chronic laryngitis, contact ulcers and granulomas of the larynx, nodules of the vocal cords, Reinke edema, subglottic stenosis, laryngotracheal stenosis, paroxysmal laryngeal spasms, chronic coughing, globus pharyngeus, and laryngeal and hypopharyngeal carcinomas.[1,4–6]

In patients who have no history of laryngopharyngeal diseases, the presence of laryngopharyngeal symptoms should raise suspicion of LPR.[7] Physicians must be aware of symptoms that may be associated with LPR and they should include the possibility of LPR in their diagnostic work-up. Recognizing the clinical symptoms of LPR and confirming the diagnosis requires deliberate attention.

LPR may cause various visible changes on oropharyngeal and laryngeal mucosae. In these patients, the expected mucosal changes are subjectively evaluated with the naked eye during endoscopic examinations that rely on the interpretation of endoscopic images. When we look at an object, the color reflected back the most is perceived by our brains as being the color of that object.[8] Colors in nature are produced by some combination of the three primary colors red, green, and blue (RGB) whose ratios vary from 0 to 255. A 100% (255) mixture of these three colors is perceived as white; a 0% (0) mixture is perceived as black. When RBG percentages differ, the tones we see vary accordingly.[9] RGB measurements are employed in various endoscopic procedures and programs like Adobe Photoshop Elements 7.0 (Adobe Systems Incorporated), which can identify RGB values of chosen points or areas of photographs downloaded to a computer. RGB measurements provide an objective numeric value, so the degree of pathology of a tissue can be interpreted according to RGB values. Indeed, the correlation of RGB values and severity of illness is well documented, especially in intestinal mucosal lesions.[8]

Based on this information about RGB, we hypothesized that color changes in oropharyngeal and laryngeal mucosa could be measured objectively with RGB measurements of the areas affected by LPR. If significant RGB changes were identified, then this would be an objective and reliable method to support subjective methods currently in use. For this purpose, RGB values of particular points on digital photographs were assessed in patients and volunteers and compared longitudinally to investigate the auxiliary efficiency of this widely available, cheap, and easy-to-use method for LPR diagnosis.

MATERIALS AND METHODS

Seventy-two patients who presented to our otolaryngology clinic and were diagnosed with LPR as described below plus 35 healthy volunteers were included in the study. Patients had an age range of 18–60 years and had LPR complaints: aphonia, excessive throat flow or postnasal flow, coughing after meals or in bed, insistent coughing, dyspnea or choking attack, chest pain, and feeling stomach contents in the mouth caused by retrosternal burning. We excluded patients younger than 18 years and older than 60 years, those using a relevant drug (Proton-pump inhibitor (PPI), H_2-receptor antagonist (H_2R) blocker, oral inhaler, etc), had

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laryngeal surgery in the past, had comorbidities (eg, tumor, liver and renal diseases, or pregnancy), smoking or consuming alcohol, did not agree to do a photo shoot, with mental retardation, and uncooperative.

In our study, the number of healthy volunteers was determined by power analysis. It is noted that the numbers of patients in the present study were similar to the numbers of patients in recent LPR-related studies.[9,10]

All participants were asked to complete a Reflux Symptom Index (RSI) form, a nine-item widely used scale designed to identify LPR in patients in terms of related symptoms.[11,12] Each item is scored from 0 (no problem) to 5 (severe problem), for a maximum score of 45. According to Belafsky et al, a score of 13 or higher is not normal and supports the diagnosis of LPR.[13]

Reflux Finding Scores (RFS) of all the patients were evaluated and recorded by physicians during laryngeal endoscopic examinations. The RFS is an eight-item assessment of the clinical severity of LPR based on observations during endoscopic laryngoscopy. The RFS values were recorded in a blinded manner by one of the authors, who is experienced at oropharyngeal and laryngeal endoscopy but had no information about the subjects and the treatment. Scores can range from 0 (no abnormal findings) to a maximum of 26. Scores higher than 7 are highly suggestive of the presence of LPR.[14] LPR is diagnosed and medical treatment is initiated when RFS values are higher than 7 and RSI scores are higher than 13.[15]

Patients who had an initial diagnosis of LPR, that is, who had reflux-related complaints during the past month and who also scored higher than 13 for RSI and higher than 7 for RFS, were included in the study. All patients were administered 20 mg of esomeprazole twice a day for 2 months in addition to being given recommendations about diet and lifestyle changes to decrease LPR. At the end of the first month, three of the patients who did not comply with the prescribed treatment protocol were excluded from group 2. In the second month, four patients who did not return for examination were excluded from group 3. Measured RSI and RFS values were recorded after each endoscopic examination. Many different agents are used in the treatment of LPR in the literature, but we used esomeprazole 20 mg twice a day (BID) because it is quite common.[16–18]

Study protocol

Approval was obtained from the local ethics committee. Both the patients with LPR symptoms and the healthy volunteers were informed about the research project and their consent was obtained before participating in the study. A workflow diagram of the four groups is given in Figure 1.

RGB measurement

During otorhinolaryngology examinations, anterior plicas, tonsils, uvula, and posterior oropharynx were photographed by using a 0° 4-mm endoscope, and laryngeal regions were also photographed by using a 70° 8-mm endoscope. In the oropharyngeal region (Figure 2A), RGB measurements were made at a total of 18 different points, that is, three points each in six particular regions (right anterior plica, left anterior plica, right tonsil, left tonsil, uvula, and posterior pharynx). In the laryngeal region, a total of 12 different RGB measurements were made (Figure 2B) at three different points each of four specific regions (right vocal cord, left vocal cord, interarytenoid region, and epiglottis). When the circular structure in a 1-mm diameter area is matched on these standard points, the Adobe Photoshop Elements 7.0 program automatically gives their RGB values. These points were chosen according to literature where the oropharynx and the larynx have been shown to have an effect on LPR. Also, we wanted these spots that we choose cover all lower areas of oropharynx and the larynx that were affected by reflux.[10–12]

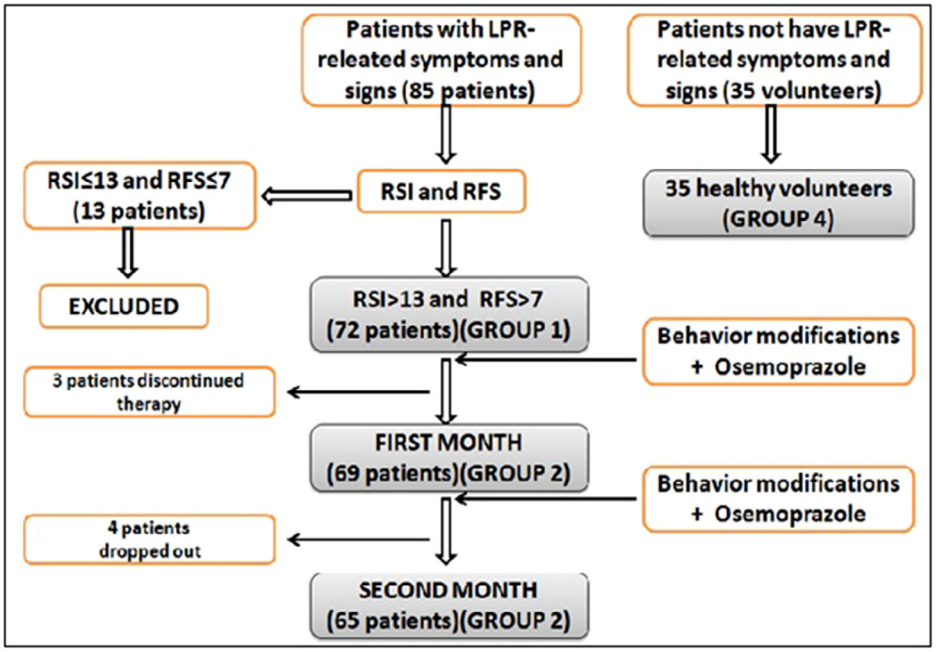

FIGURE 1. Workflow diagram of patients and volunteers.