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Novel endoscopic scoring system after sinus surgery

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ABSTRACT

Objective: To propose a simple post-operative endoscopic scoring system for use after endoscopic sinus surgery (ESS) in patients with chronic rhinosinusitis (CRS), and to demonstrate the usefulness of this approach.
Methods: Subjects comprised 116 patients (84 men, 32 women; mean age, 54 years) with CRS who were analyzed endoscopically and radiologically after ESS between 2006 and 2012. The study was designed as a case series with planned data collection in the setting of university medical centers. Patients were followed-up for ≥6 months after ESS (mean, 13.1 months). Both pre- and post-operative computed tomography (CT) findings of each sinus and olfactory cleft (OC) were scored according to the Lund–Mackay scoring system: 0, normal; 1, partially; or 2, completely occupied. CT score represents the total score expressed as a percentage of the maximum possible score (12 points per side). Post-operative endoscopic score (E score, %) was calculated as the maximum score according to physical findings on each operated sinus and OC: 0, normal; 1, partially diseased; or 2, completely closed. Post-operative course using E score was verified by comparison with the Lund–Kennedy (L–K) scoring system.
Results: E score was easily and quickly determined. Interclass correlation coefficient among 10 otolaryngologists indicated high-level inter-rater reliability (0.922). E score correlated strongly with both CT score ($n = 116$, $p < 0.0001$, $r_s = 0.755$) and L–K score ($n = 79$, $p < 0.0001$, $r_s = 0.723$).
Conclusion: Endoscopic evaluation using E score for sinuses and OCs after ESS is a useful method, together with L–K score for the nasal cavity and radiological study.

1. Introduction

Medical treatment is the first choice for individuals with rhinosinusitis [1], but surgical management is indicated for chronic rhinosinusitis (CRS) that proves refractory to medical therapy. Endoscopic sinus surgery (ESS) is a standard surgical procedure for patients with CRS [2,3]. Post-operative outpatient intranasal treatments, such as removal of clotting fibrin and/or blood crusts under endoscopy and medication, are also very important to prevent recurring exacerbation [4,5]. For post-operative management, intranasal findings after ESS should be evaluated radiologically, and the Lund–Mackay (L–M) scoring system has been widely employed [6]. However, in practice, routine examination using computed tomography (CT) is sometimes difficult, due to issues such as radiation exposure and financial burden. Methods for easy evaluation of intranasal physical findings using endoscopy are therefore important [7–9]. The Lund–Kennedy (L–K) scoring system [10] for endoscopic evaluation of the 'nasal cavity' has been used for post-operative evaluation in previous studies [11–13], but few reports have described endoscopic findings of the "paranasal sinuses". Systems for scoring the condition of the paranasal sinuses currently vary among institutions and have not been methodologically clarified [14,15].

This study proposed a simple post-operative endoscopic score (E score) for sinonasal findings after ESS. To assess the inter-rater reliability and validity of this E score, we examined agreement on E score between raters, and whether E score correlated closely with previously reported radiological and endoscopic nasal scores.

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2. Methods

2.1. Patients

Between January 2006 and June 2012, we performed ESS on 607 patients with CRS. The present study analyzed only patients who underwent both endoscopic and radiological examinations after ESS. In total, 116 adult patients (84 men, 32 women) with CRS who underwent primary bilateral ESS at Hyogo College of Medicine ($n = 79$; 72 men, 7 women) and Showa University ($n = 37$; 12 men, 25 women) were enrolled. Mean age at the time of surgery was 54.2 years (range, 20–80 years). The study utilized a case series design involving two university medical centers, and conformed to the regulations of the ethics committee of Hyogo College of Medicine (approval number 1512). Patients who had undergone any sinus surgeries previously, who had associated sinonasal tumorous diseases, or who did not undergo sinonasal CT after ESS were excluded from the study.

CRS was diagnosed when nasal respiratory symptoms (including nasal obstruction, rhinorrhea, post-nasal drip, and cough) were observed for more than 3 months, based on guidance provided by the Japan Rhinologic Society, and referring to previous reports from Europe [16] and the United States [17]. Surgical management in the form of ESS for patients with CRS was indicated when nasal symptoms and physical findings did not improve despite medical therapy for at least 3 months. ESS was performed on all patients only after obtaining informed consent in accordance with the guidelines of the ethics committees of Hyogo College of Medicine and Showa University. All patients underwent bilateral ESS in hospital under general ($n = 113$) or local anesthesia ($n = 3$). Mean duration of post-operative follow-up was 13.1 months (range, 6–60 months). The 37 patients (24 men, 13 women; mean age, 50.7 years) diagnosed with eosinophilic CRS (ECRS) all completely fulfilled the following criteria: (i) symptoms of nasal congestion and olfactory disorder; (ii) bilateral CRS with nasal polyps (CRSwNPs), (iii) peripheral blood eosinophilia (>7.0%), and (iv) ethmoid sinus-dominant opacification on preoperative CT (i.e., ethmoid sinuses (E) were more bilaterally occupied than the maxillary sinuses (M), E/M $\geq$1) [18].

For post-operative management, intranasal topical treatment was performed once every 1–2 weeks. Medical therapy with antibiotics, mucinolytics, anti-allergic agents, and nasal or oral corticosteroids, and nasal irrigation with saline was performed for each patient until post-operative sinonasal mucosal condition had stabilized. When these agents were not administered for at least 1 month, post-operative intranasal conditions were evaluated both endoscopically (E score) and radiologically (CT score).

2.2. CT score

Both pre- and post-operatively, CT findings of the maxillary, frontal, anterior and posterior ethmoid and sphenoid sinuses, and olfactory clefts (OC) were scored using the following scale in accordance with the L–M scoring system: 0, no opacification; 1, partial opacification; and 2, complete opacification [6]. Percentage of the total score to the maximum possible score (12 points per side) was taken as the CT score.

2.3. Post-operative E score (E score)

E score was determined using the same 4-mm-diameter rigid endoscopes (0° and 70°; Karl Storz Endoscopy, Tokyo, Japan) applied for ESS. Post-operatively, endoscopic appearance of the operated sinuses and OCs was scored as follows: 0, normal condition; 1, sinus only partially observable due to occupation by polyps, edematous mucosa, and/or discharge; and 2, unobservable due to complete occupation by polyps and/or discharge (Fig. 1). When the polyps occupied and prevented observation of the back part of the sinuses, the back sinuses that were operated on were counted as 2 points. The percentage of the total score to the maximum possible score for operated sinuses was rated as the E score. Sinuses that had not been operated on could be excluded from scoring. However, all sinuses were bilaterally operated on in all patients ($n = 116$), and the E score to the maximum possible score (24 points) was rated in this study.

To assess inter-rater reliability and validity of the E score, agreement between raters and correlations with L–K score and CT score were analyzed. For the analysis of inter-rater reliability, six patients were randomly selected and their E-scores rated by 10 otolaryngologists. The mean level of experience of the otolaryngologists was 8.4 years (range, 2–16 years). Otolaryngologists determined E scores using endoscopic images captured during post-operative treatment.

We then analyzed the differences between E score and CT score. The absolute difference (Δscore) was calculated for each patient as $|\Delta\text{score}| = |\text{CT score} - \text{E score}|$. To analyze the effect of middle meatus obstruction on E score, total bilateral scores for the anterior ethmoid sinus were individually summed and evaluated as three groups: normal appearance, 0 points (Group A); partial lesion, 1–2 points (Group B); and fully obstructed lesion, 3–4 points (Group C).

We also evaluated the endoscopic appearance of the 'nasal cavity' using the previously reported L–K score [7] for comparison with E score after ESS in this study. Condition of the nasal cavity, including crusting, adhesion, polyps, edema, and discharge, was endoscopically scored on the following scale: 0, normal; 1, mild; and 2, severe. The percentage of the total score to the maximum possible score (10 points per side) was used as the L–K score. In this study, we were only able to collect data from 79 patients treated at Hyogo College of Medicine for the comparison between L–K score and E score.

2.4. Statistical analysis

Continuous variables are presented as mean $\pm$ standard error with ranges, and categorical variables are presented as frequencies and percentages. Agreement in E score between raters was assessed through inter-rater reliability with the use of the intraclass correlation coefficient. Correlations of E score with post-operative L–K and CT scores were assessed using Spearman's correlation coefficient.

For evaluation of post-operative course, differences between pre- and post-operative CT scores were analyzed using the Wilcoxon signed-rank test.

All p values are two-sided and values of $p < 0.05$ were considered to indicate statistical significance. All statistical analyses were performed using SPSS version 17.0 software (SPSS, Tokyo, Japan).

3. Results

3.1. Inter-rater reliability of E score

The inter-rater reliability of E score was assessed using the interclass correlation coefficient (Fig. 2). Mean E scores for Patients A, B, C, D, E, and F were 88.8% (range, 83.3–100%), 0%, 6.7% (range, 0–29.2%), 40.8% (range, 25.0–70.8%), 37.5% (range, 20.8–45.8%), and 24.6% (range, 12.5–45.8%), respectively. CT scores for Patients A, B, C, D, and F were 75.0%, 0%, 45.8%, 58.3%, and 16.7%, respectively. The interclass correlation coefficient was 0.922, with a two-sided 95% confidence interval of 0.801–0.986.

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