Glottal Function Index: A Predictor of Glottal Disorders in Children

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Objectives: Hyperkinetic laryngeal behaviors may be used to achieve glottal closure in the presence of vocal cord disorders. In adults, the Glottal Function Index (GFI) is a validated self-administered survey used to evaluate glottal insufficiency. In children, the relationships between glottal closure and vocal cord lesions have not been examined. We undertook to evaluate the efficacy of the GFI in detecting disorders of the vocal cords in children.

Methods: We evaluated 100 consecutive children who underwent flexible fiberoptic laryngoscopy. A 4-item GFI questionnaire was administered to the parents of each study subject on study entry. The videotapes of the examinations were evaluated and scored by 3 investigators in a blinded manner. The GFI scores were compared in subjects with and without vocal cord findings.

Results: The final analysis included 100 children 2 to 16 years of age. The mean age of the study group was 7.3 years (±3.9 years). Of the 100 patients, 54 had vocal cord disorders. The most common was vocal cord nodules, in most cases combined with bowing of the vocal cords; the two variables were highly correlated (p < .01). We performed a receiver operating characteristics test between the presence of vocal cord disorders and the GFI score. We found that the “optimal” score, on which the sensitivity and specificity curves cross, was 3. Of the 54 patients who had vocal cord disorders, the index identified 38 patients (70%), whereas the patients’ complaints identified only 30 patients (55.6%). This difference was statistically significant (p < .05).

Conclusions: The GFI is a reliable 4-item symptom index with excellent correlation to the presence of vocal cord lesions in children.

Key Words: Glottal Function Index, hoarseness, vocal cord nodule.

INTRODUCTION

The prevalence of voice disorders in children in most surveys is 6% to 9%. Vocal cord nodules are the most common laryngeal disorder in children.¹ Voice disorders of various causes commonly present with effortful phonation, vocal fatigue, breathiness, and odynophonia due to the glottal insufficiency. For example, a mass on the vocal cords, such as a polyp, nodule, or papilloma, will interfere with vocal cord closure, and vocal cord paralysis or paresis will create a gap during phonation, forcing the compensatory supraglottic mechanism to go into action.²

The evaluation of voice disorders in children includes a detailed history including medical details, birth, growth, and development. Speech and language history is also obtained, followed by a detailed voice history to determine the cause of the voice disorder and its contributing factors. Physical examination should concentrate on the head and neck and be followed by examination of the larynx via rigid or flexible endoscopy.

Almost all of the studies on vocal cord lesions in children have been conducted on children with abnormal voices. On the other hand, Sataloff³ has stated that vocal nodules can be asymptomatic and not interfere with voice production. So, which children require endoscopy? Only very hoarse children? Or is there a more accurate diagnostic tool for patient selection? Is there a tool that can assess the effect of treatment interventions?

The Glottal Function Index (GFI) is a validated, reliable, and easily self-administered 4-item battery that is aimed specifically at identifying the presence and degree of vocal cord dysfunction in adults.⁴ This study was designed to evaluate the validity and reliability of the GFI in detecting vocal cord disorders in children as found during flexible laryngoscopy.

METHODS

The GFI has been employed as an instrument for
evaluating glottal insufficiency. The first step in using the GFI for Hebrew-speaking patients was to translate the questionnaire. Validation of the Hebrew questionnaire included translation of the original instrument from English to Hebrew by 3 independent translators and reverse translation from Hebrew to English by 3 other translators. In the United States, patients completed the original and back-translated questionnaires. Score correlation of the two instruments was performed by correlation coefficient analysis.

Validation of the questionnaire for pediatric patients was then performed by measuring the association between the mean GFI score and the findings upon flexible endoscopy.

We slightly modified the GFI to be appropriate for children by addressing the questions to the child’s parents. The scale of this modified index remains the same, ranging from a minimum score of 0 to a maximum score of 20 (Table 1).

In the second part of the study, the parents of 132 consecutive children 2 to 16 years of age who were referred for transnasal nasopharyngolaryngoscopy for various reasons were asked to complete the GFI questionnaire. All endoscopic procedures were performed with the patient awake, after topical application of a nasal decongestant mixed with topical anesthesia (phenylephrine hydrochloride 0.25% with lidocaine hydrochloride 1%). Each patient received a serial number. All endoscopic examinations were recorded to a videocassette and received a serial number. The patients’ data, including GFI scores, were put in an Excel database. Videos of the examination were later reviewed by 3 of the authors (J.T.C.; Y.O.-K.; A.D.), and pathological findings were noted. The examiners were blinded to the patients’ complaints and the indication for endoscopy. The findings were also tabulated in the database.

To evaluate whether the GFI test was better for identifying patients with vocal problems than simply asking the patients if they suffer from hoarseness, we used a receiver operating characteristics (ROC) curve analysis. The ROC curve analysis is a common test used to compare two or more laboratory or diagnostic tests. The ROC curve is a graphical representation of the tradeoff between false-negative (sensitivity) and false-positive (specificity) rates for every possible cutoff.

RESULTS

The initial part of this study was the Hebrew GFI translation validation. Fourteen patients in the United States completed the original and the back-translated questionnaires. The correlation coefficient (r) of the two was 0.92 (p < .001). Therefore, no bias could be attributed to translation of the questionnaire.

Of 132 children examined, in 105 there was adequate visualization of the larynx to enable the authors’ full evaluation of the larynx. Five questionnaires were not fully answered and were excluded from the study. We included 100 children 6 to 12 years of age in the final analysis. The median age of the study group was 6 years (mean, 7.3; SD, 3.9); 65 were boys and 35 were girls. Of the 100 patients, 54 had disorders of the vocal cords (treatment group). The vocal cord disorders found are listed in Table 2. The most common disorder found was vocal cord nodules (86% of disorders), which in most cases had bowing in 26 cases (Table 2). No significant difference was found between the ages of the children in the control and treatment groups. The median age of the control group was 6 years (mean, 7.2; SD, 4.2) and that for the treatment group was 6.75 years (mean, 7.5; SD, 3.6). There were more boys than girls in the treatment group (35 boys and 19 girls), in contrast to the control group, in which the numbers were equal (23 boys and 23 girls).

The median score for the GFI index was 4 (mean, 5.03; SD, 5.4). The mean of the control group was 2.5 (SD, 3.88), and the mean of the treatment group was 7.2 (SD, 5.6).

Of 32 children whose chief complaint was a...
hoarse voice, 30 children (94%) had video findings of disorders of their vocal cords. However, among those without complaints, 24 patients also had such problems.

An ROC test was performed to indicate whether the patient had a vocal cord disorder as a function of the GFI index. We found that the “optimal” score, on which the sensitivity and specificity curves cross, was 3 (see Figure). Of the 54 patients who had vocal cord disorders, the index identified 38 patients (70%), whereas the patients’ complaints identified only 30 patients (55.6%). The sensitivity of the GFI was 70%, and the specificity was 72%.

DISCUSSION

Vocal nodules can be asymptomatic and not interfere with voice production. On the other hand, it is not only nodules that cause hoarseness. In which cases is endoscopy required? There is a need for a diagnostic tool to assist in patient selection. Reports on the incidence of voice disorders in children reveal large variations. Of a total of 162 kindergarten children and schoolchildren, 38 (23.4%) had hoarseness, and vocal nodules were diagnosed in 7 of 10 children examined. In an attempt to explore the actual prevalence of vocal cord nodules, Akif Kilic et al. examined 617 children 7 to 16 years of age. Vocal cord nodules were found in 21.6% of the boys and in 11.7% of the girls. In this study we found that hoarse children had vocal cord disorders (mostly vocal cord nodules) in 94% of cases. As in the previous study, vocal nodules were more common among boys in our work.

Vocal cord polyps, nodules, bowing, or paralysis can cause impairment of vocal cord closure. This disorder is termed glottal closure insufficiency. In compensation, hyperkinetic laryngeal behaviors are used. These behaviors include anterior-posterior and lateral-medial compressions that necessitate effort and energy, causing symptoms such as effortful phonation, vocal fatigue, and pain during phonation.

Hyperkinetic laryngeal function in children may be an indication of underlying glottal insufficiency in the face of an organic voice disorder.

The GFI was developed at the Center for Voice Disorders of Wake Forest University as an instrument for evaluating glottal insufficiency and its response to therapy. The GFI contains only 4 items, each aimed at assessing symptoms of glottal dysfunction. For this study, the GFI was slightly modified to be appropriate for children by referring the questions to the children’s parents.

We found that the “optimal” score, on which the sensitivity and specificity curves cross, is 3. Using this “threshold” score on the GFI index enables us to better identify children who have vocal cord disorders. It improved our ability to detect vocal cord disorders from the 55.6% rate achieved by just relying on a history of hoarseness to a rate of 70%. A child with symptoms of hoarseness will probably undergo an office flexible fiberoptic examination. However, we found that when we relied only on patients’ complaints, we missed 15% of the children with vocal cord disorders that would have been detected if the GFI had been the screening tool. Should we examine “asymptomatic nodules”? Perhaps they are not so asymptomatic, if one asks the right questions. The GFI may help us to better understand the relationship between vocal cord disorders and voice. Also, for treatments such as speech therapy, the GFI might be a good baseline instrument for estimating improvement (or lack of it) of the voice. It is important to be able to relate vocal cord disorders to the voice they produce. The GFI has been useful in that respect in adults. This study validated its usefulness in children.

CONCLUSIONS

The GFI is a reliable 4-item symptom index with excellent correlation to the presence of vocal cord lesions in children. It can help to improve evaluation of children with voice disorders, especially those with vocal cord lesions. It may have additional value in the examination of children before and after treatment.

REFERENCES


