Diagnostic Testing for Vocal Fold Paralysis: Survey of Practice and Evidence-Based Medicine Review

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Objectives/Hypothesis: Vocal fold paralysis continues to be a dominant topic in laryngology. Although the majority of cases can be attributed to a known etiology, a significant number of patients present without a clear precipitating event. Over 1,500 studies regarding vocal fold paralysis exist in the medical literature, although only a small percentage report on the use of serum or radiographic testing for the evaluation of idiopathic paralysis. Despite this, patients are routinely subjected to diagnostic evaluation to investigate the underlying cause. To characterize contemporary practice, a national survey of the American Broncho-Esophagological Association (ABEA) membership was undertaken. It is hypothesized that the current practice of diagnostic testing for idiopathic vocal fold paralysis is not well supported by an evidence-based medicine (EBM) review of the available medical literature. Study Design: The authors conducted a national survey, systematic EBM review of existing literature. Methods: Surveys were mailed to all active ABEA members; responses regarding practice specialization as well as serum/radiographic diagnostic preferences for idiopathic vocal fold paralysis were tabulated and subjected to statistical analysis. To compare contemporary practice with evidence in the available literature, an EBM review was first performed. Articles for evaluation were selected from a Medline search of English-language abstracts related to adult vocal fold paralysis. The publications were individually reviewed and an EBM level and grade were assigned and compared with the survey results. Results: Eighty-four of 249 active members responded with 76 (31%) replies submitted for analysis. Specific serum tests were advocated by 41 of 76 (54%) respondents, although the majority (52 of 65 (80%) felt that they were only “occasionally” or “never” necessary. The most common tests were rheumatoid factor (38%), Lyme titer (36%), erythrocyte sedimentation rate (34%), and antinuclear antibody (33%). Fifty-one of 71 (72%) felt that computed tomography (CT) was “always” or “often” necessary and 50 of 72 (69%) replied that chest radiography (CXR) was “always” or “often” necessary. There was no significant difference between CT and CXR ordering (P < .51). In contrast, magnetic resonance imaging (MRI) was described as “always” or “often” necessary in 28 of 71 (39%) of the surveys, significantly less than CT (P < .0001). There was no statistical impact of practice specialization on ordering of serum tests (P = .25) or imaging (P = .50 for CT; P = .46 for CXR; P = .45 for MRI). Following analysis of 1,510 vocal fold paralysis abstracts, 19 publications were found to be appropriate for an EBM review of serum testing with 15 available for review of radiographic imaging. Only one study presented level III evidence; the remainder were levels IV and V comprised of retrospective series and case reports. The evidence supporting serum or radiographic testing toward the evaluation of idiopathic vocal fold paralysis is given an overall grade of “C.” Conclusions: Serum and radiographic testing for the evaluation of vocal fold paralysis is supported by grade “C” evidence only. There are no existing prospective studies estimating the clinical impact of testing on diagnosis or patient outcome. Current practice, as estimated by a survey of the ABEA membership, is not well founded for serum testing and only by retrospective case series with regard to imaging. Further study into the nature of idiopathic vocal fold paralysis and outcomes assessment of diagnostic paradigms may improve clinical practice. Key Words: Vocal fold paralysis, diagnostic testing, computed tomography, chest radiograph, idiopathic.
INTRODUCTION

“Vocal cord paralysis is a clinical finding of great interest to the otolaryngologist.”

The opening sentence to Maisel and Ogura’s 1974 paper is true today, as vocal fold paralysis continues to be a dominant issue in clinical laryngology. The interest and importance of this area of study reflects the impact of laryngeal dysfunction on voice, swallowing, and airway regulation. The first step in diagnostic management often relates to the etiology of the impairment. Although the overall incidence and prevalence of vocal fold paralysis in the general population is unknown, the main categories recorded in large series are idiopathic, iatrogenic, and neoplastic cases. The nature of vocal fold paralysis may be changing over time; several authors have pointed out that the incidence of recurrent laryngeal nerve injury from thyroid surgery, for example, has decreased relative to other causes such as extralaryngeal malignancy and operations for disease of the cervical spine.

When the clinician is confronted with a patient who presents with vocal fold paralysis and no clear etiology, such as known thoracic malignancy or postoperative dysfunction immediately after carotid artery surgery, it is the otolaryngologist’s primary duty to evaluate the patient for possible causes. This has been the advocated practice paradigm for decades, although the precise approach has been a matter for debate. The three principle domains for diagnostic testing in this clinical scenario are blood tests, imaging studies, and laryngeal electromyography. There have been several previous papers regarding the use of testing in the diagnostic evaluation of vocal fold paralysis, and they are referred to in this report. In 1992, Terris et al. published an investigation that reviewed their series of patients with vocal fold paralysis to estimate the cost and use of adjunctive testing such as serum and radiographic examinations. This was supplemented by an interview survey of 31 colleagues to assess their practice regarding idiopathic vocal fold paralysis; the authors concluded that there is “great variability among the diagnostic practices of otolaryngologists who evaluate patients with vocal cord paralysis of unknown origin.”

One contemporary ideal for improvement of clinical care is the practice of evidence-based medicine (EBM), in which a systematic review of the best studies available from the scientific research is executed, disseminated, and hopefully integrated with patient and physician values and experience. The scientific work scrutinized by the EBM process should be patient-centered and relevant to the clinical question posed by the reviewer. The final step depends on the clinician successfully incorporating the evidence into patient management.

Recently, a multidisciplinary task force has reported on an EBM review of laryngeal electromyography (LEMG), one of the diagnostic modalities closely associated with vocal fold paralysis. Although this thorough work did not limit its scope to “idiopathic” cases, those reports did conclude that there is only “class IV,” the lowest available level of evidence, for the diagnostic and prognostic use of LEMG in vocal fold paralysis. Because an EBM review has been performed for LEMG, it is not repeated here.

Idiopathic vocal fold paralysis continues to represent a significant (11–37%) fraction of new cases, with these clinical issues in mind, the present study was executed to accomplish several objectives. The basic research questions are as follows: What are the current practices regarding the diagnostic evaluation of idiopathic fold vocal paralysis as estimated by a national survey of practitioners (the American-Broncho-Esophagological Association [ABEA] membership)? What is the evidence in the scientific literature that supports serum and/or radiographic testing for vocal fold paralysis and how is that literature graded from an EBM standpoint? Are the contemporary practice patterns revealed in the survey supported by evidence in the literature? A critical discussion of the evaluated literature will follow after the results of the survey and EBM review.

METHODS

Survey of the American Broncho-Esophagological Association

After receiving permission from the ABEA, a 19-item survey was mailed to 249 active ABEA members (see Fig. 1). A return address, stamped envelope was included with the survey; there were no identifying features on any respondent’s form. The ABEA was selected as a group of reasonable size and geographic distribution that would offer a breadth and depth of clinical experience from which to answer questions regarding the diagnostic management of vocal fold paralysis.

The first item of the survey asked participants what percentage of their practice consisted of laryngology and/or bronchoesophagology (BE): 0% to 25%, 26% to 50%, 50% to 75%, or more than 75%. This item was selected as a group of reasonable size and geographic distribution that would offer a breadth and depth of clinical experience from which to answer questions regarding the diagnostic management of vocal fold paralysis. The respondents were asked to rate a series of diagnostic investigations for their necessity in evaluating the patient. For each, the ABEA members rated them as “always necessary,” “often necessary,” “occasionally necessary,” and “never necessary.” The focus of the present thesis relates to testing for a hypothetical adult patient with “no obvious precipitating cause” for their acute vocal fold paralysis. The introductory letter that was sent with the original survey explicitly stated that this was a survey regarding contemporary management of adult patients. The respondents were asked to rate a series of diagnostic investigations for their necessity in evaluating the patient.

After biostatistical consultation, the weighted kappa statistic, McNemar test, and Bowker’s test were used to examine agreement of paired categorical responses to assess the respondents’
1. What percentage of your clinical practice is devoted to laryngology/broncho-esophagology?
   - 0-25%
   - 26-50%
   - 51-75%
   - >75%

2. Please arrange the following in order of their prevalence in your population of patients with unilateral vocal fold motion impairment (UVFMI). (Place the numbers 1-5, 1 being most common)
   - Idiopathic
   - Iatrogenic
   - Neoplastic
   - Trauma (non-surgical)
   - Primary neurological

3. Please rate these symptoms in terms of their relationship to UVFMI.
   (1=very common, 2=fairly common, 3=occasionally seen, 4=rarely or never seen)
   - Dysphonia
   - Dysnea
   - Choking episodes
   - Painful phonation
   - GERD
   - Dysphagia
   - Vocal fatigue

4. Please rate these physical exam findings in terms of their relationship to UVFMI.
   (1=very common, 2=fairly common, 3=occasionally seen, 4=rarely or never seen)
   - Dysphonia
   - Changes in external landmarks of larynx
   - Glottic incompetence
   - Stridor
   - Rotation of the larynx on endoscopic examination
   - Benign vocal lesions
   - Bowing
   - Vertical height discrepancy between the vocal folds

5. Please rate the importance of the following diagnostic tools in the evaluation of UVFMI.
   (1=always necessary, 2=often necessary, 3=occasionally necessary, 4=never necessary)
   - Videostroboscopy
   - Flexible laryngoscopy
   - Direct laryngoscopy (under general anesthesia)
   - Chest radiograph
   - CT scan with contrast along course of recurrent laryngeal nerve (RLN)
   - MRI with gadolinium along course of RLN
   - Blood tests

6. If you do order laboratory tests in the evaluation of UVFMI, which ones do you order?
   - Rheumatoid factor
   - Anti-nuclear antibody
   - Lyme titer
   - VDRL
   - ESR
   - CBC
   - Chemistry panel
   - Other (specify:)

7. What medications (if any) do you use in the management of UVFMI? (mark all that apply)
   - Systemic corticosteroids
   - Antiviral medications
   - Proton pump inhibitors/H2 blockers
   - Inhaled corticosteroids
   - None
   - Other (specify:)

8. How would you characterize your role in the performance of diagnostic laryngeal electromyography? (other than EMG guidance for botulinum toxin injections)
   - Electrode placement only
   - Electrode placement and interpretation
   - Interpretation only
   - Neither placement or interpretation

9. If you do not perform the technical component (electrode placement) of the laryngeal EMG, who does?
   - Physiatrist
   - Speech-language pathologist
   - Another otolaryngologist
   - Neurologist

10. If you do not provide the interpretive component of laryngeal EMG for your patients, who does?
    - Physiatrist
    - Speech-language pathologist
    - Another otolaryngologist
    - Neurologist

11. What type of electrodes are used in the laryngeal EMG performed on your patients?
    - Monopolar
    - Bipolar
    - Hook-wire
    - I don’t know what is used

12. If you do not perform the technical or interpretive components of laryngeal EMG for your patients, are the persons performing the EMG “blinded” to clinical information regarding the case?
    - Yes
    - No

13. Do you feel that laryngeal EMG is more accurate if performed in a “blinded” manner or with the clinical information known?
    - Blinded
    - Clinical information known to electromyographer

14. If you perform your own laryngeal EMG, please provide us with your opinions to these questions:
    a. Can recruitment/interference be graded?
    b. Does the degree of recruitment reflect the degree of laryngeal innervation?
    c. Can the denervation be quantified?
    d. Do other findings, such as waveform morphology/spontaneous activity, contribute to the determination of the degree of muscle innervation?

15. Which laryngeal muscles are tested when laryngeal EMG is performed on your patients?
    (1=always tested, 2=often tested, 3=occasionally tested, 4=never tested)
    - Thyroarytenoid
    - Cricoarytenoid
    - Interarytenoid
    - Posterior cricoarytenoid
    - Cricopharyngeus
    - Lateral cricoarytenoid

16. When you perform injection laryngoplasty, what percentage of the time is it done with the patient awake and in the clinic setting? (As opposed to taking the patient to the operating room)
    - Never
    - 1-25%
    - 26-50%
    - 51-75%
    - 76-100%

17. What is your preferred material for temporary vocal fold medialization by injection laryngoplasty?
    - Bovine collagen
    - Human collagen (Cymetra)
    - Gelfoam
    - Fat
    - Other (specify:)

18. What is your preferred material for permanent vocal fold medialization?
    - Gore-Tex
    - Silastic
    - Teflon
    - Voice implant system
    - Fat injection
    - Local tissue (cartilage/muscle)
    - Montgomery implant system
    - Titanium
    - Other (specify:)

Fig. 1. American Broncho-Esophagological Association (ABEA) active membership survey. ABEA survey as distributed to the active membership (appears over two separate pages).
choices of diagnostic tests. The results from the serum testing and imaging questions are compared with the respondents’ self-report of their practice composition to determine any impact of subspecialization. The Mantel-Haenszel $\chi^2$ trend test was used to compare the categories of testing “necessity” (always, often, occasionally, never) in relation to practice specialization. These were individually confirmed with Fisher exact test.

**Evidence-Based Medicine Review, Assignment of Levels, and Overall Grade**

Publications for review were retrieved from a MEDLINE search of papers from 1966 through June 2005. Prior studies that were noted in the references of these papers were also selected based on their appropriateness for review. The following limits were placed on the abstracts for review: publications in English, human studies, and investigations regarding adults only. The main search term used for the EBM review was “vocal paralysis” resulting in a database of 1,466 publications. To capture all the information from related medical subject headings (MeSH; Fig. 2), these variations were also queried, although this only extended the total to 1,510 entries, because most were captured with the principal search term.

The titles and abstracts were scrutinized to identify articles that provide information that may address the specific clinical question: “In adults with unilateral vocal fold paralysis and no apparent cause, does serum and/or radiographic testing provide diagnostic information helpful to the clinician?” For serum testing, if either the specific blood test or the prototypical disease with which it is associated (Lyme disease and Lyme titer, for example) were evaluated as a cause of vocal fold paralysis, this was included in the EBM review. These serum tests and their associations are reviewed in Table I. If the abstract was promising with regard to this question, the full text article was reviewed, including the bibliography, and assigned a level of evidence in accordance with EBM principles. The basis for these levels and grades is outlined in Table II. An expert consultant was asked to review scientific methodology if there was any question about the determination of the level for any given paper. For retrospective, uncontrolled case series, assignment of a level was straightforward.

**TABLE I.**

<table>
<thead>
<tr>
<th>Test</th>
<th>Abbreviation</th>
<th>Common Associated Disorder for Serum Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laryngeal electromyography</td>
<td>LEMG</td>
<td></td>
</tr>
<tr>
<td>Chest radiograph</td>
<td>CXR</td>
<td></td>
</tr>
<tr>
<td>Computed tomography scan with contrast along course of recurrent laryngeal nerve</td>
<td>CT</td>
<td></td>
</tr>
<tr>
<td>Magnetic resonance imaging with gadolinium along course of recurrent laryngeal nerve</td>
<td>MRI</td>
<td></td>
</tr>
<tr>
<td>Blood tests</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rheumatoid factor (rheumatoid arthritis)</td>
<td>RF</td>
<td>Rheumatoid arthritis, other autoimmune disorders</td>
</tr>
<tr>
<td>Antinuclear antibody</td>
<td>ANA</td>
<td>Systemic lupus erythematosus</td>
</tr>
<tr>
<td>Lyme titer</td>
<td></td>
<td>Lyme disease</td>
</tr>
<tr>
<td>Venereal Disease Research Laboratory assay</td>
<td>VDRL</td>
<td>Syphilis</td>
</tr>
<tr>
<td>Erythrocyte sedimentation rate</td>
<td>ESR</td>
<td></td>
</tr>
<tr>
<td>Complete blood count</td>
<td>CBC</td>
<td></td>
</tr>
<tr>
<td>Chemistry panel</td>
<td></td>
<td>Electrolyte imbalance, diabetes mellitus</td>
</tr>
</tbody>
</table>

**TABLE II.**

<table>
<thead>
<tr>
<th>Evidence-Based Medicine Levels and Grades.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Levels of evidence</td>
</tr>
<tr>
<td>Level 1: Randomized, controlled trials or a systemic review (meta-analysis) of randomized, controlled trials</td>
</tr>
<tr>
<td>Level 2: Prospective (cohort or outcomes) study with an internal control group or a systematic review of prospective, controlled trials</td>
</tr>
<tr>
<td>Level 3: Retrospective (case–control) study with an internal control group or a systematic review of retrospective, controlled studies</td>
</tr>
<tr>
<td>Level 4: Case series without an internal control group (retrospective reviews; uncontrolled cohort or outcome studies)</td>
</tr>
<tr>
<td>Level 5: Expert opinion without explicit critical appraisal, case reports, or recommendation based on physiology/bench research</td>
</tr>
<tr>
<td>Evidence-based medicine grades</td>
</tr>
<tr>
<td>Grade A, level 1</td>
</tr>
<tr>
<td>Grade B, level 2, 3</td>
</tr>
<tr>
<td>Grade C, level 4</td>
</tr>
<tr>
<td>Grade D, level 5</td>
</tr>
</tbody>
</table>

Fig. 2. Medical subject heading (MeSH) terms related to “paralysis, vocal cord.”

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An overall grade of the collection of systematically reviewed publications is based on the presence of “levels” of evidence for the question being reviewed. For example, if a particular clinical question features numerous prospective, controlled, nonrandomized studies (level 2) in addition to some case–control studies (level 3) but no body of randomized, controlled trials, this would be assigned an EBM grade of “B.” A body of literature comprised of case reports and retrospective series without a comparison group would be assigned a grade of “C.”

RESULTS
The results are presented in two sections: the survey findings are presented first subdivided into serum and radiographic investigations. A separate section regarding the results of the EBM review then follows.

Overview
Eighty-four of the 249 surveys mailed to active members of the ABEA were returned; eight of the surveys were returned incomplete with communication from the respondent that their participation was limited by a predominantly pediatric practice. This resulted in a total of 76 surveys to be included in the analysis, constituting 31% of mailed surveys.

With regard to practice composition, 31 respondents (41%) reported that laryngology and/or bronchoesophagology comprised less than 25% of their practice, 18 (24%) reported that it comprised 25% to 50% of their practice, 15 (20%) reported that it comprised 51% to 75% of their practice, and 12 (16%) reported that it comprised more than 75% of their practice.

The survey respondents were asked to describe the most common etiologies of vocal fold paralysis in their practice; the *iatrogenic* and *idiopathic* categories were the first and second most common, as can been seen in Figure 3.

Serum Testing
For adult unilateral vocal fold paralysis with no apparent cause, the respondents were asked to rate the importance of serum testing by describing it as always necessary, often necessary, occasionally necessary, or never necessary. Sixty-five of the 76 (86%) respondents answered this question; their results are noted in Table III. Seventy percent of respondents felt that blood tests were at least occasionally necessary, although only a minority (20%) felt that they were always or often necessary.

The following question asked “If you do order laboratory tests in the evaluation of vocal paralysis, which ones do you order?” The survey contained checklists of seven laboratory tests and a space for “other” tests not listed and an opportunity to write in a study of interest to the survey.

### Table III. Survey Responses Regarding Necessity of Diagnostic Testing for Adult Acute Unilateral Vocal Paralysis With No Known Precipitating Cause.

<table>
<thead>
<tr>
<th>Test</th>
<th>Always necessary</th>
<th>Often necessary</th>
<th>Occasionally necessary</th>
<th>Never necessary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum Testing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n = 65)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CXR</td>
<td>4 (6%)</td>
<td>17 (24%)</td>
<td>32 (46%)</td>
<td>6 (8%)</td>
</tr>
<tr>
<td>CT With Contrast Along Course of RLN (n = 71)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MRI With Gadolinium Along Course of RLN (n = 71)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Each cell is reported as the number of respondents in each category and a percentage of that column’s total.

CXR = chest x-ray; CT = computed tomography; MRI = magnetic resonance imaging; RLN = recurrent laryngeal nerve.
Radiographic Investigations

Survey participants were asked about the role of chest radiography (CXR), computed tomography (CT), and magnetic resonance imaging (MRI) in the management of acute unilateral vocal fold motion impairment with no obvious precipitating cause. Again, the respondents were asked to rate the importance of these imaging modalities by describing them as always necessary, often necessary, occasionally necessary, or never necessary. At least 71 of the 76 (93%) of the respondents answered this question regarding imaging; their results are noted in Table III. Computed tomography (with contrast) along the course of the recurrent laryngeal nerve was felt to be “always” or “often” necessary by 51 of 71 (72%) respondents, just slightly more popular that CXR, which was felt to be “always” or “often” necessary by 50 of 72 (69%) participants. There was no significant difference in the respondents’ selection of CT compared with CXR in this survey (P < .51).

MRI (with gadolinium) along the course of the recurrent laryngeal nerve was not as common of a choice for the evaluation of acute unilateral vocal fold motion impairment compared with CT (P < .0001), although 28 of 71 (38%) respondents felt that it was “always” or “often” necessary. In parallel with the findings relating to serum testing, biostatistical analysis failed to reveal any statistically significant impact of practice specialization on ordering of CT (P = .50), CXR (P = .46), or MRI (P = .45).

In summary, survey respondents equally favored CXR and CT for evaluation of vocal fold paralysis with no apparent cause, and 69% to 71% believed them to be “always” or “often” necessary. MRI was less likely to be requested. Practice specialization was not found to have any impact on radiographic test ordering.

Systematic Literature Review and Assignment of Evidence-Based Medicine Grade

Overall, there is only a modest collection of literature providing support toward answering the clinical question, “In adults with unilateral vocal fold paralysis and no apparent cause, does serum and/or radiographic testing provide diagnostic information helpful to the clinician?” Of the 1,510 abstracts reviewed, only 19 publications provided information regarding serum testing and vocal fold paralysis related to the specific disorders being tested for. Fifteen articles provided information about CXR, CT, or MRI as it pertained to the clinical question posed.

The levels of evidence for the papers reviewed are presented in Table V (serum testing) and Table VI (radiographic evaluation). A few of the reviewed publications appear in both tables, as they provide information for each of the topics. Overall, there were no papers presenting level I or II evidence; only one paper, Schechter’s 1972 cross-sectional study of the prevalence of vocal fold paral-
ysis in diabetics, presented level III evidence. The bulk of papers reviewed are levels IV and V, the lowest levels of evidence in the scale. This results in an overall EBM grade of "C" for both serum and radiographic testing.

DISCUSSION

The primary diagnostic concern for every physician evaluating a patient with vocal fold paralysis is establishing the underlying etiology. Given the nature of the potential causative disorders such as carcinoma of the lung, it is the duty of the practitioner to consider these entities. The discussion of the diagnostic investigations reviewed in this thesis is predicated on the presumption that correctly determining the cause of the etiology for vocal fold paralysis is the ordering physician's objective and that this testing is directly beneficial to the patient in question. However, it is not known whether there is a quality-of-life or survival benefit in finding a positive CT scan for carcinoma of the lung that has already caused vocal fold paralysis, for example. It may be cost-effective to perform screening CTs for lung cancer\(^47\) in general, but its value in the specific subset of patients presenting with laryngeal impairment is unknown.

The following discussion reviews some limitations to the ABEA survey; an in-depth analysis of several key studies evaluated for the EBM review follows. The results from the survey are considered in light of the EBM review.

### Possible Limitations of the American Broncho-Esophagological Association Survey

Estimating the clinical behavior of all otolaryngologists from a mail survey of the ABEA, or any subgroup, is problematic. First of all, it is not known if the choices submitted by any survey's respondents reflect their actual practice, idealized actions, or neither. Can the survey information from a society of specialty practitioners be extrapolated to otolaryngologists as a whole? Perhaps these physicians are exposed to a different composition of patients with vocal fold paralysis, as an example of one possible difference. However, some reassurance about the

<table>
<thead>
<tr>
<th>Article</th>
<th>Level of Evidence</th>
<th>Laboratory Test/Disease</th>
<th>Number of Patients With Vocal Paralysis</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hagan, 1963(^{12})</td>
<td>IV</td>
<td>VDRL, glucose</td>
<td>113</td>
<td></td>
</tr>
<tr>
<td>Shuman and Weissman, 1968(^{22})</td>
<td>IV</td>
<td>Diabetes</td>
<td>20</td>
<td>Eleven of 20 vocal paralysis patients had diabetes</td>
</tr>
<tr>
<td>Schechter, 1972(^{23})</td>
<td>III</td>
<td>Diabetes</td>
<td>53 diabetic inpatients, 200 diabetic outpatients 225 nondiabetic controls</td>
<td>Only case–control review in EBM evaluation; 4.3% of diabetics with paralysis, 0.44% of controls</td>
</tr>
<tr>
<td>Blau, 1972(^{24})</td>
<td>IV</td>
<td>VDRL, ESR</td>
<td>21</td>
<td>These 21 patients were screened with these tests</td>
</tr>
<tr>
<td>Maisel and Ogura, 1972(^{21})</td>
<td>IV</td>
<td>Glucose, VDRL, ESR, CBC</td>
<td>127</td>
<td>Case report</td>
</tr>
<tr>
<td>Chijimatsu, 1980(^{25})</td>
<td>V</td>
<td>Sarcoidosis</td>
<td>1</td>
<td>Two of 25 were felt to have diabetes as a possible cause of their vocal paralysis</td>
</tr>
<tr>
<td>Berry and Blair, 1980(^{26})</td>
<td>IV</td>
<td>Diabetes</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Swinburn et al., 1986(^{27})</td>
<td>V</td>
<td>Sarcoidosis</td>
<td>1</td>
<td>Case report</td>
</tr>
<tr>
<td>Kabadi, 1988(^{28})</td>
<td>V</td>
<td>Diabetes</td>
<td>1</td>
<td>Case report</td>
</tr>
<tr>
<td>Schroeter et al., 1988(^{29})</td>
<td>V</td>
<td>Lyme disease</td>
<td>1</td>
<td>Case report</td>
</tr>
<tr>
<td>Kraus et al., 1990(^{30})</td>
<td>V</td>
<td>ANA</td>
<td>1</td>
<td>Case report</td>
</tr>
<tr>
<td>Tobias et al., 1990(^{31})</td>
<td>V</td>
<td>ACE</td>
<td>1</td>
<td>Case report: earliest with ACE level discussed</td>
</tr>
<tr>
<td>El-Kassimi et al., 1990(^{32})</td>
<td>V</td>
<td>Sarcoidosis</td>
<td>1</td>
<td>Case report</td>
</tr>
<tr>
<td>Espana et al., 1990(^{33})</td>
<td>V</td>
<td>ANA</td>
<td>1</td>
<td>Case report</td>
</tr>
<tr>
<td>Moralee et al., 1992(^{34})</td>
<td>V</td>
<td>K</td>
<td>1</td>
<td>Case report of hypokalemia resulting in vocal paralysis</td>
</tr>
<tr>
<td>Sommer and Freeman, 1994(^{35})</td>
<td>IV</td>
<td>Glucose</td>
<td>3</td>
<td>Case report</td>
</tr>
<tr>
<td>Jaffe et al., 1994(^{36})</td>
<td>V</td>
<td>Sarcoidosis</td>
<td>1</td>
<td>Hydralazine induced lupus with vocal paralysis; larynx returned to normal as drug was removed</td>
</tr>
<tr>
<td>Hari et al., 1998(^{37})</td>
<td>V</td>
<td>ANA</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Imauchi et al., 2001(^{8})</td>
<td>V</td>
<td>ANA</td>
<td>2</td>
<td>Two of two patients with elevated ANA in lupus</td>
</tr>
</tbody>
</table>

VDRL = Venereal Disease Research Laboratory; EBM = evidence-based medicine; ESR = erythrocyte sedimentation rate; CBC = complete blood count; ANA = antinuclear antibody; ACE = angiotensin-converting enzyme; K = potassium.
applicability of the ABEA results comes from the survey responses in which each participant characterized their degree of specialization (laryngology and/or bronchoesophagology). It bears repeating that none of the surveyed items revealed any association between practice composition and diagnostic testing. Although one may expect a self-selected group such as the members of the ABEA to have some homogeneity, the breadth of practice type in the ABEA as revealed by the range of practice composition reflects some variability in experience and allows some degree of extrapolation to the general population of otolaryngologists.

Serum Testing Is Not Valuable in the Evaluation of Vocal Paralysis

Serum testing for “idiopathic” vocal fold paralysis has been advocated for decades as a standard screening tool.1,10,12,47 This has been called into question by several important papers. Terris et al., in 1992, published a series of patients and survey of practitioners in which diagnostic testing was scrutinized.8 This study recommended a practice paradigm for radiographic imaging and concluded that serum testing “should not be routinely ordered.” Although this important paper’s conclusions were practical and reasonable, a systematic review of the literature was beyond the scope of the study. Terris’ study has been supplemented in this report by a national survey of contemporary practice rather than a predominantly regional one as well as by an evidence-based systematic review of the available literature regarding causes of vocal fold paralysis that may be detected with serum testing.

MacGregor, as noted in the “Introduction,” published a survey of U.K. practitioners in 199444 and also condemned the routine use of serum tests. In his survey, a larger number of practitioners reported that they would request a complete blood cell count, ESR, and testing for syphilis than indicated by the contemporary ABEA survey. Available comparisons among the MacGregor, Terris, and ABEA surveys are seen in Table VII. It should be noted that the comparison among these surveys is limited in several ways; for one, MacGregor’s respondents were asked to supply their complete testing protocol in their reply as opposed to checking off a provided list as in the ABEA survey. Of course, the surveys were also conducted at different times and in different medical and medicolegal environments. In general, it appears that ABEA survey respondents use serum testing more modestly than in the U.K. study. Should they be used at all? A closer examination of some of the tests reveals little evidence to support this practice.

Two of the most commonly noted serum tests in this survey were rheumatoid factor (RF) and the antinuclear antibody. The RF test is most closely associated with rheumatoid arthritis (RA) but may also be positive in

---

**TABLE VI.**
Radiographic Imaging for Unilateral Vocal Paralysis: Levels of Evidence.

<table>
<thead>
<tr>
<th>Evidence Level</th>
<th>Imaging Modality</th>
<th>Total Number of Patients</th>
<th>Number of Idiopathic Patients</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>CXR</td>
<td>633</td>
<td>181</td>
<td>Forty-three of 173 had positive CXR; notable impact on survival if CXR-positive</td>
</tr>
<tr>
<td>IV</td>
<td>CXR</td>
<td>113</td>
<td>11</td>
<td>Routinely used CXR for screening</td>
</tr>
<tr>
<td>IV</td>
<td>CXR</td>
<td>21</td>
<td>21</td>
<td>Many original patients diagnosed by CXR alone</td>
</tr>
<tr>
<td>IV</td>
<td>CXR, CT</td>
<td>127</td>
<td>34</td>
<td>Thirteen of 18 left-sided patients with negative CXR had positive findings in the mediastinum</td>
</tr>
<tr>
<td>IV</td>
<td>CT, plain tomography</td>
<td>14</td>
<td>N/A</td>
<td>Recommended MRI for “proximal lesions” and CT for “distal” lesions</td>
</tr>
<tr>
<td>IV</td>
<td>CT, MRI</td>
<td>48</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>CXR</td>
<td>155</td>
<td>45</td>
<td>CXR useful in the initial evaluation; 2 of the 45 “idiopathic” cases were later found to have tumors</td>
</tr>
<tr>
<td>IV</td>
<td>CXR, CT, MRI</td>
<td>187, 84 evaluated</td>
<td>36</td>
<td>Sixty percent yield for MRI; 54% for CXR, 35% for CT</td>
</tr>
<tr>
<td>IV</td>
<td>CT</td>
<td>69</td>
<td>N/A</td>
<td>All malignancy patients</td>
</tr>
<tr>
<td>IV</td>
<td>CXR, CT</td>
<td>169</td>
<td>47</td>
<td>All chest lesions were detectable on CXR</td>
</tr>
<tr>
<td>IV</td>
<td>CXR, CT, MRI</td>
<td>98</td>
<td>36</td>
<td>Sixty percent yield for MRI, 55% for CT neck, 62% CT chest</td>
</tr>
<tr>
<td>IV</td>
<td>CT, MRI</td>
<td>49</td>
<td>38</td>
<td>High false-positives in “low-suspicion” group</td>
</tr>
<tr>
<td>IV</td>
<td>CT</td>
<td>40</td>
<td>34</td>
<td></td>
</tr>
</tbody>
</table>

CXR = chest radiograph; CT = computed tomography; MRI = magnetic resonance imaging.
TABLE VII.

Available Comparisons of Terris and MacGregor Surveys with the ABEA Survey for Serum Testing; Percentage of Respondents Who Order These Specified Tests at Least "Sometimes."

<table>
<thead>
<tr>
<th>Test</th>
<th>Terris, 1992</th>
<th>MacGregor, 1994</th>
<th>ABEA, Total Respondents, 2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBC/FBC</td>
<td>23%</td>
<td>93%</td>
<td>25%</td>
</tr>
<tr>
<td>ESR</td>
<td>26%</td>
<td>82%</td>
<td>34%</td>
</tr>
<tr>
<td>VDRL/syphilis</td>
<td>N/A</td>
<td>66%</td>
<td>22%</td>
</tr>
<tr>
<td>Chemistry/glucose</td>
<td>26%</td>
<td>N/A</td>
<td>17%</td>
</tr>
</tbody>
</table>

ABEA = American Broncho-Esophagological Association; VDRL = Venereal Disease Research Laboratory; ESR = erythrocyte sedimentation rate; CBC = complete blood count; FBC = full blood count.

Sjögren syndrome and systemic lupus erythematosus (SLE); the ANA is most closely associated with SLE, in which it may be positive for 95% of patients. Very few of the reviewed articles, however, provided support for testing in these cases. There are a handful of case reports regarding SLE and vocal fold paralysis noted in the review but little else to support the practice of routinely ordering an ANA test by 33% of the survey respondents overall and 61% of those who order blood tests in general.

The yield from RF testing is probably quite low as well. Since Montgomery's Triological thesis advanced our understanding of cricoarytenoid arthritis in 1963, RA has been part of the differential diagnosis in laryngeal motion impairment, because the mechanically immobile fold may clinically mimic the neurologically impaired vocal fold. Although it is not known what percentage of patients with vocal fold paralysis has RA, Montgomery did report that 26 of his 100 patients with RA had some level of laryngeal motion impairment. He does not, however, discuss laboratory testing in the routine evaluation of these patients. He states "... A majority of our cases of cricoarytenoid arthritis has been associated with generalized rheumatoid arthritis." So even in the case when RA is suspected, it is unlikely that vocal fold motion impairment is the sole or initial presentation of the disease, further calling into question the practice of measuring RF levels for vocal fold paralysis.

One recent paper, however, did highlight other possibilities in the association of RA with vocal fold paralysis. Thompson-Link et al. published a series of three patients with RA and vocal fold paralysis (some bilateral) based on cervicomедullary compression resulting from to atlantoaxial joint disease; in these cases, the direct cause of vocal fold immobility was neural compression proximally and not cricoarytenoid joint arthritis. Again, however, all three patients had a longstanding history of RA and this did not represent a new diagnosis of the disease.

Lyme disease, a tick-borne infection caused by the spirochete Borrelia burgdorferi, was ordered by 36% of survey respondents despite the fact that there was only one specific case report in the literature regarding Lyme disease and vocal fold paralysis. One of the earliest reviews of Lyme disease in the otolaryngology literature did note, however, that 13 of 266 (4.9%) patients had hoarseness and six of 266 (2.2%) had dysphagia. There is no mention, however, if the laryngeal symptoms were caused by vocal fold paralysis. Interestingly, if patients without a "typical" history are considered, that is without erythema migrans (a hallmark of Lyme disease) or history of tick bite, they were found to have a higher rate of laryngeal symptoms. Hoarseness was noted in four of 41 (9.8%) and dysphagia in three of 41 (7.3%). It is conceivable that the association of Lyme disease and facial paralysis provided some theoretical basis for Lyme titer testing by the ABEA survey participants.

In comparison to the previously mentioned tests, survey respondents were less likely to order a "chemistry panel." Although not explicitly stated on the form, this familiar term was chosen because it includes, at least, electrolytes (sodium and potassium) and a determination of serum glucose. This option was marked by 17% of participants; interestingly, this is one of the areas with supporting literature beyond case reports. In 1968, Shuman and Weissman published a small note in the journal Diabetes in which 183 patients with vocal fold paralysis were reviewed; a diagnosis was made in 163. Of the remaining 20 "idiopathic" cases, 11 (55%) were found to be diabetic. Interestingly, four were "newly" diagnosed diabetics on presentation to the hospital for evaluation of voice changes. Two of 25 patients in Berry's 1980 article regarding "vagal mononeuritis" were believed to have diabetes as the causal entity. Whether Berry's patients were known diabetics or their disease was detected with serum testing during the evaluation for vocal fold paralysis is not reported. In each of these papers, testing for serum glucose and consideration of diabetes in the evaluation of vocal fold paralysis is suggested.

Schechter provided the only cross-sectional study in this EBM review with his 1972 paper examining the incidence of vocal fold paralysis in inpatient diabetics, outpatient diabetics, and nondiabetic outpatients at one medical institution. He found that three of 53 (5.6%) of the inpatient diabetics and eight of 200 (4%) of the outpatient diabetics had vocal fold paralysis on laryngoscopy. This was compared with the one in 225 (0.44%) rate in nondiabetic controls at the same outpatient clinic. Although the contribution of diabetes to vocal fold paralysis may be multifactorial, suggested mechanisms may include diabetic neuropathy or through comorbid conditions such as stroke. Schechter also considered that the actual lifetime incidence in diabetics is likely higher than the overall 4.3% (11 of 253) rate in that some patients may have transient paralysis, which has been reported in this patient population. A one-time laryngoscopic survey of subjects naturally fails to capture the overall lifetime incidence of this clinical finding.

Although this level IV and supportive level III evidence are relatively suggestive, testing for glucose as part of the chemistry panel was the least commonly requested specific testing option of those listed on the ABEA survey. It is conceivable that respondents did not consider glucose as part of a chemistry panel; nonetheless, only one survey participant went on to specify "glucose" as the "other test" option. Electrolyte testing had little support in the literature as an independent consideration toward clinical evaluation of vocal fold paralysis, except for one case report.
that featured reversible vocal fold paralysis believed to be related to hypokalemia.\textsuperscript{34}

Other than the listed choices, the participants were allowed to enter any serum testing choices on the form. Two each selected fluorescent treponemal antibody testing (as a marker for syphilis in addition to the Venereal Disease Research Laboratory assay listed in the same survey question), thyroid function tests, and angiotensin-converting enzyme (ACE) levels. Although there are some reports, mostly several decades old, which mentioned the practice of testing for syphilis in the evaluation of vocal fold paralysis,\textsuperscript{1,12,24} this was not reported as a significant diagnostic step by any paper. Measurement of the ACE level as a diagnostic test for sarcoidosis, however, was noted by a series of case reports associating this disease with vocal fold paralysis.\textsuperscript{25,27,31,32,36} In all five cases, however, the patients also had hilar lymphadenopathy on CXR. Three of four patients for which an ACE level was reported had elevated levels. It is likely that the ACE level is only meaningful if a screening CXR is abnormal and the radiographic findings are suggestive of hilar changes.

In summary, the practice of serum testing for the evaluation of idiopathic vocal paralysis is not supported by any level I or II evidence. Blood tests were ordered by a significant percentage of study participants; for most of the diseases and serum tests associated with them, however, there is only anecdotal or case series information to support this practice.

Diagnostic Imaging

**Overview.** The scientific literature regarding radiographic investigation into idiopathic vocal fold paralysis is comprised predominantly of level IV evidence, also resulting in an EBM grade of “C.” Chest radiography, CT, and MRI have been advocated by various authors for different reasons, although no study has directly compared any two modalities in a prospective manner for the evaluation of idiopathic vocal fold paralysis. The following discussion reviews the strengths and weaknesses of key papers from the existing literature.

Chest radiography has been the principal radiographic modality for the evaluation of vocal fold paralysis with no apparent cause for most of the last century.\textsuperscript{1,5,8,11,12,24,39,42,44} The impact of a positive finding on CXR was demonstrated by Huppler in a review of 633 patients with vocal fold paralysis from the Mayo Clinic, of which 181 were believed to be “idiopathic.” The subgroup of 43 of 173 idiopathic patients with positive CXR findings had mean 5-year survival rate of 58% compared with 95% for patients with idiopathic vocal fold paralysis with negative CXR. One would presume that this reflected a significant incidence of neoplastic disease on CXR; it was noted by the authors, however, that the bulk of the positive findings were not neoplasms but disorders such as goiter, pulmonary fibrosis, and other significant but nonmalignant processes.

As a historical note, other forms of plain radiography have also been examined in the evaluation of vocal fold paralysis. Before the advent of CT scanning, plain tomograms of the larynx were used in laryngeal evaluation. Isshiki described the characteristic tomographic findings in a series of 56 patients with vocal fold paralysis; in 11 of the 19 idiopathic cases, he was able to characterize identifiable tomographic changes that aided the distinction from other forms of neuropathy. These findings include tilting of the thyroid cartilage and a superior position of the affected vocal fold at rest. Another modality was examined by Agha in 1983 when he compared CT with laryngography for vocal fold paralysis patients;\textsuperscript{45} in this case, he felt that laryngography actually provided superior information about the status of the laryngeal innervation but that CT was the recommended modality for evaluation of idiopathic vocal fold paralysis. Neither plain tomography nor laryngography continues to have any significant role in clinical management of vocal fold paralysis at this time, however.

**Advantages and Disadvantages of Computed Tomography and Chest Radiography; Lesser Role for Magnetic Resonance Imaging.** The principal discourse that has appeared in more recent level IV studies has revolved around the role of CXR and CT scan in the evaluation of the patient with vocal fold paralysis. MRI has also been studied in this context; this is reviewed subsequently.

The importance and potential superiority of CT scanning was heralded in 1983 when Glazer et al. reported on a series of patients with extralaryngeal causes of vocal fold paralysis.\textsuperscript{39} Of the 77 cases of paralysis overall, 33 had no suspicion of laryngeal trauma or malignancy and underwent evaluation with a CT scan. This retrospective series featured a remarkable rate of positive findings on CT: 27 of 33 patients (14 with a history of nonlaryngeal malignancy) were found to have a neoplasm during CT evaluation of the course of the recurrent laryngeal nerve. Remarkably, 13 of the 18 (72%) of the left sided cases with aortopulmonary masses on CT scan had normal-appearing mediastinum on CXR. The mediastinal masses in the negative CXR/positive CT group had a mean size of 2.3 cm. The smallest mass detected in the positive CXR group was 3.8 cm (mean, 4.6 cm for the group), indicating that the pathologic mass can become fairly large before detection on CXR. For the eight of 11 positive CT scans performed to evaluate right-sided paralysis, however, the CT findings only confirmed abnormalities of physical examination or conventional radiography. This publication alerted practitioners to the possibility of false-negative CXR in patients with vocal fold paralysis.

In contrast to the very select group reported by Glazer, Benninger published an important paper on a series of 47 patients with vocal fold paralysis and no apparent cause;\textsuperscript{44} this patient population did not appear to have as high of a rate of previous known malignancy and probably more accurately represent the experience of an otolaryngologist evaluating vocal fold paralysis. Of the 47 cases in Benninger’s study, 28 had positive CT findings, still a significant portion of findings. In the remaining 19 cases, the only radiographic abnormalities noted were seen on CT scan of the “neck.” The authors noted that “no patients had a thoracic etiology that was not identified by CXR.” Their proposed algorithm was to use CXR as a screening tool; if this is negative, then CT scan of the neck should follow. It should be carefully noted that their description CT of the neck extends from “the base of
When reviewing their series of malignancies as a cause of vocal fold paralysis, Furukawa et al. also advocated a “side-specific” evaluation that included ultrasound of the neck and CXR; if these initial tests were not revealing, a CT chest should follow for left-sided paralyses only. Again, whereas this statistical evaluation of their experience is interesting, it is difficult to directly apply to the practice of otolaryngology in which a significant proportion of patients will be without any malignancy as a cause of their laryngeal neuropathy. Of note, Furukawa also noted a gender distinction with a higher rate of lung and esophageal cancer in males and thyroid cancer in females; this gender distinction became part of their paradigm with only males undergoing contrast esophagrams as a follow up to the ultrasound and CXR for right-sided paralysis.

In the one of the few papers to discuss the cost of diagnostic imaging for paralysis, Liu et al. reported on a series of patients who underwent either MRI or CT imaging. The authors recommend that patients with vocal fold paralysis should be stratified into “low-suspicion” and “high-suspicion” cases based on their clinical history such as having a known malignancy. With this distinction into “risk” groups, there were no false-negatives in the CT or MRI examination for the “high-suspicion” group. The “low-suspicion” patients had a high rate of false-positives, mostly on MRI. Liu and colleagues concluded that the cost of imaging to find a space-occupying lesion in a low-suspicion patient is 4.5 times higher than in the high-suspicion group and that these cost issues should be considered in their management. Interestingly, there were two of 29 true-positive imaging cases in the low-suspicion group, one of which was from a mediastinal mass; the authors did not report whether there were positive findings on CXR for this patient. Although the effort to maximize diagnostic yield and contain cost is an important one, it should be restated that we do not know what the impact of early identification of vocal fold paralysis in a “low-suspicion” patient is compared with finding a mass in a patient who already has a known malignancy. Does this really change the overall patient survival or quality of life? Spending less for each finding is one important way to examine the problem but does not answer these additional questions.

With regard to MRI in general, the existing literature does not provide much evidence for or against MRI in the evaluation of vocal fold paralysis beyond the limitations discussed here. Although several papers report a high yield (60%) for MRI, it should be noted that these were retrospective studies and the 60% figure is derived from an aggregate total of only six of 10 patients with positive MRI findings. Although MRI is quite good at predicting recurrent laryngeal nerve invasion in thyroid cancer, it has a high-false positive rate in low-suspicion patients, which may make it less desirable as an imaging modality for vocal fold paralysis.

Diagnostic Imaging: Summary. Practitioners clearly believe that imaging is important. The ABAE survey respondents felt that CT and CXR are “always” or “often” necessary in 70% of cases. The lack of any difference between CT and CXR ordering in the survey responses may reflect the absence of strong studies that demonstrate the benefit of one over the other—or at least ones in which the precise role of CT and CXR are better defined.

As noted previously, several of the papers make practice recommendations based on side of paralysis. This is the result of the course to the differing path of the recurrent laryngeal nerve on each side of the body. A publication from Hughes et al. recently studied a group of 24 right-sided vocal fold paralysis cases of which nearly half were iatrogenic in nature. With regard to screening radiography, none of the remainder was found to have a primary thoracic disease accounting for their vocal fold paralysis. As investigations move toward defining a pathway for imaging in vocal fold paralysis, differential imaging dependent on the side of paralysis may be a valuable consideration.

Without a careful prospective examination of outcomes in patients with vocal fold paralysis and direct comparisons between modalities, it will remain difficult to make a practice recommendation based on scientific evidence. It could be argued that CXR should continue to be used as screening based on its relatively low cost and high yield (upward of 50% in some series). In practical terms, however, the usefulness of those findings should be considered. If the intended plan is to proceed with CT as a follow up to positive findings on CXR—or, conversely, to further scrutinize the chest following a negative CXR by obtaining a CT anyway—then what was the point of the CXR in the first place? This has not been answered for the evaluation of vocal fold paralysis.
Idiopathic Vocal Fold Paralysis: Future Directions for Investigation

Would there be any need for broad serum or radiographic testing if a precise understanding of the nature of idiopathic vocal fold paralysis existed? The pathophysiology of this entity has been debated for some time with many authors directly or indirectly speculating that the model of viral neuropathy such as in “Bell palsy” could also be applied to our understanding of idiopathic vagal paralysis. Adour,57 among others, advanced the idea of herpes simplex virus (HSV) as the etiologic agent in the pathophysiology of “idiopathic” facial paralysis and also implicated it in vagal neuropathy.58 Although some reports of HSV-associated vagal facial paralysis and also implicated it in vagal neuropathy as the etiologic agent in the pathophysiology of “idiopathic” facial paralysis and also implicated it in vagal neuropathy.58 Although some reports of HSV-associated vagal neuropathy are more easily detected59–62 than others, it stands open to question whether HSV is a principal cause of what has been previously described as “idiopathic” fold vocal paralysis. Indeed, antiviral treatment of suspected but unconfirmed neuropathy affecting the larynx has been advocated in the literature63 and was noted as a therapeutic option in the routine management of idiopathic paralysis by 14 of 76 (18%) respondents to the ABEA survey. The discussion regarding the imaging and serum testing required for evaluation of vocal fold paralysis may change as our understanding of this disease becomes more refined.

Another question regarding “idiopathic” paralysis has been raised by several authors. When a patient has been thoroughly screened for the etiology of vocal fold paralysis and no lesion has been revealed by imaging, is this sufficient? Very little information beyond anecdotal reports is available to predict the likelihood of the actual pathological lesion becoming apparent after the original diagnostic workup. Ward64 commented that two of the original 39 “idiopathic” vocal fold paralysis cases in his series each eventually presented with vagal schwannoma 3 and 5 years after the original evaluation. Willat and Stell42 provide a strong caution to remain vigilant in their review of 37 “idiopathic” vocal fold paralysis cases that did not recover spontaneously in 1 year’s time. Four of the 37 (11%) patients were eventually diagnosed with a malignancy that “in retrospect had been responsible for their vocal paralysis.” The patients in this important publication, including the four with tardive presentation of malignancy, were not initially screened with CT. When is it appropriate to reimage patients whose idiopathic paralysis does not recover?

Future investigators have much to study in this arena. Perhaps the role of HSV in vagal neuropathy will be better understood and viral titers, for example, will alter the need for routine imaging. Ideally, a prospective study in which CT and CXR are obtained on all patients with “idiopathic” vocal fold paralysis will be able to answer some of the questions posed here.

CONCLUSIONS

American Broncho-Esophagological Association Survey Results

Contemporary practice regarding the diagnostic evaluation of vocal fold paralysis with no apparent cause includes a significant amount of routine serum testing with 20% of respondents reporting that it is “always” or “often” necessary. Seventy-one percent of the survey participants believed that blood tests are at least “occasionally” necessary. The most commonly ordered blood tests are RF, Lyme titer, ESR, and ANA. Radiographic information from CXR and CT scan along the course of the recurrent laryngeal nerve is valued by the survey respondents; MRI is less likely to be ordered. The degree of practice specialization does not appear to have any impact on the frequency of diagnostic testing ordered.

Evidence-Based Medicine Review

There is some level IV and level V evidence supporting the use of serum diagnostic testing for disorders that may cause vocal fold paralysis. Although there is one level III study regarding the association of diabetes and vocal fold paralysis, the overall EBM grade for this review is a “C.” With regard to the role of radiographic imaging in the evaluation of vocal fold paralysis with no apparent cause, the evidence is more consistently at level IV, although the overall EBM grade assigned is also a “C,” comprised of retrospective reviews and case reports.

Are Contemporary Practice Patterns Supported by Evidence-Based Medicine?

The level of routine serum testing reported in the ABEA survey for the evaluation of “idiopathic” vocal fold paralysis is not supported by the EBM review of the literature. Routine serum testing is not justified in this clinical scenario. For radiographic testing, the preference of CT and CXR appears to be supported by a moderate amount of level IV literature as compared with MRI. The lack of any difference between CT and CXR ordering in the survey responses may reflect the absence of strong studies that demonstrate the benefit of one over the other.

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