The Evolving Etiology of Bilateral Vocal Fold Immobility


Philadelphia, Pennsylvania

Summary: In the past, bilateral vocal fold immobility (BVFI) occurred most commonly after thyroidectomy. However, no large series documenting the etiology of adult BVFI has been published within the past fifteen years. This study reviews the etiologic patterns of BVFI at our institutions. We compare BVFI from before and after 1980. We also review combined studies of unilateral vocal fold immobility (UVFI) to compare and unilateral versus bilateral etiologic trends. In comparison with previously published series, fewer cases of BVFI present today as a complication of thyroid surgery and more as the result of malignancies and nonsurgical trauma. Unfortunately, BVFI caused by malignancy is not usually an initial sign of local disease, but an ominous sign of recurrence or metastases. In comparing UVFI and BVFI we found that thyroidectomy causes a higher percentage of BVFI than of UVFI. Over one-third of UVFI cases were caused by neoplasm which further underscores the potential seriousness of immobile vocal folds and the need for careful investigation.

Key Words: Etiology—Diagnosis—Vocal fold immobility.

INTRODUCTION

The presentation of a patient with bilateral vocal fold immobility (BVFI) varies. Initially a patient may have a breathy voice without respiratory complaints. Over time the voice improves as airway symptoms worsen. By the time patients with BVFI present for surgical management they often have dyspnea or stridor with an apparently normal voice. Many previous articles refer to abductor vocal cord paralysis (VCP) or recurrent laryngeal nerve (RLN) paralysis. However, a distinction should be made between paralysis and immobility. A paralyzed fold implies disruption of neuromuscular innervation, whereas an immobile vocal fold can be the result of multiple causes, including both paralysis and mechanical fixation. BVFI can occur as a result of a primary disorder or as an iatrogenic complication of surgery or intubation. There are numerous metabolic, neurologic and mechanical conditions that can cause bilateral loss of vocal fold abduction.1–9

In the past, BVFI occurred most commonly after thyroidectomy.10–18 However, no large series documenting the etiology of adult BVFI has been published within the past fifteen years. This study reviews the etiologic patterns of BVFI at our
institutions. We compare BVFI from before and after 1980. We also review combined studies of unilateral vocal fold immobility (UVFI) to compare unilateral versus bilateral etiologic trends.

**MATERIALS AND METHODS**

A computer-assisted search of inpatient diagnosis codes for vocal fold paralysis yielded 482 cases of adult (>15 years of age) paralysis presenting to two urban teaching hospitals from 1982 through 1997. These charts were manually reviewed to identify patients presenting with new-onset BVFI documented by indirect and/or flexible fiberoptic laryngoscopy. Seventy-five out of 482 (15.6%) cases had BVFI.

The records were reviewed for patient identification, gender, age, date of presentation, method of establishing the existence of BVFI, diagnostic tests, treatment and final outcome. Presenting symptoms (eg, dyspnea, stridor, voice changes, dysphagia) and significant past medical and surgical history (eg, intubation, malignancy, constitutional symptoms, thyroid surgery, and unilateral fold paralysis) were tallied.

**RESULTS**

Of the 75 patients, 36 (48%) were male and 39 (52%) were female with an age range of 17 to 91 and a mean age of 60 years. As seen in Table 1, patients presented most frequently with respiratory distress. Table 2 delineates potentially contributory past medical and surgical history. Sixty percent of the patients had a previous history of intubation. Of this 60%, 31% were intubated prior to surgeries, and 29% were intubated secondary to respiratory distress. Twenty-seven percent had a known history of previous malignancy.

**TABLE 1.** Presenting Symptoms (**n** = 75)

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dyspnea</td>
<td>67%</td>
</tr>
<tr>
<td>Stridor</td>
<td>48%</td>
</tr>
<tr>
<td>Voice Impairment</td>
<td>47%</td>
</tr>
<tr>
<td>Dysphagia/Aspiration</td>
<td>19%</td>
</tr>
</tbody>
</table>

In 28 of 75 (37%) cases, the patient’s history and physical examination (H&P) revealed the correct etiology and no further evaluation was pursued. Thirty-seven of the 47 (79%) patients who were not initially diagnosed after H&P were diagnosed after further evaluation. Overall, the etiology was reached in 87% (**n** = 65) of the cases, while 13% (**n** = 10) were designated idiopathic.

Figure 1 ranks the etiologies of BVFI seen in this series according to incidence: trauma (**n** = 20, 27%), malignancy (**n** = 16, 21%), neurologic (**n** = 14, 19%), idiopathic or undiagnosed (**n** = 10, 13%), thyroid surgery (**n** = 8, 11%) and miscellaneous causes (**n** = 7, 9%). Head and neck squamous cell carcinoma (**n** = 5) was the most common malignancy causing BVFI, followed by breast cancer (**n** = 3), thyroid cancer (**n** = 2), lung cancer (**n** = 2), colon cancer (**n** = 2), prostate cancer (**n** = 1) and esophageal cancer (**n** = 1). The category of trauma included intubation (**n** = 7), nonsurgical trauma (**n** = 7), and surgery other than thyroidectomy (**n** = 6). Neurological causes included cerebrovascular disease (**n** = 3), multiple sclerosis (**n** = 2), myasthenia gravis (**n** = 1), bulbar polio (**n** = 1), Maige’s syndrome (**n** = 1), Parkinson disease (**n** = 1), multifocal white matter diseases (**n** = 1), and Arnold–Chiari malformation (**n** = 1). The seven miscellaneous causes included four patients who were determined by microscopic direct laryngoscopy to have cricoarytenoid fixation secondary to rheumatoid arthritis, one patient who had a goiter causing paralysis, and one with familial amyloidosis with progressive polyneuropathy involving the vocal folds.

Fifty-four patients (72%) required tracheotomy 14 of whom had been previously intubated. Of the remaining 21 patients, 5 required intubation, but were eventually extubated, 11 were managed medically, and 5 were treated with vocal fold surgery alone without tracheotomy. Thus, 59 of 75 patients...
DISCUSSION

Unfortunately, no longitudinal single-institution series of adults presenting with BVFI exists in the literature. In the absence of such a study, a comparison of previous series from different eras was used to help determine the etiologic trends of BVFI. Table 3 consists of the largest series of BVFI over the past 42 years.10–19 A steady decline in the proportion of BVFI attributed to thyroidectomy is seen with a concurrent rise in trauma and malignancy. A comparison of the overall studies published before and after 1980 (Figure 2) further illustrates this point.

We attribute the decreased incidence of BVFI after thyroid surgery to three factors: (1) fine-needle aspiration; (2) broadened medical management of nonmalignant thyroid disease; and (3) refinements in surgical technique. Indications for surgical management of thyroid disease have diminished as a result of these improvements. Uncomplicated Graves’ disease, for example, is typically treated with propylthiouracil, methimazole, or $^{131}$I rather than surgery. Multiple thyroid procedures (with their increased risk of RLN injury) are less common today.

Improvements in surgical technique have resulted in a decreased incidence of RLN injury.20 Surgeons are more aware of the RLN course variations, with the nerve being identified during every operation. Improved hemostasis with bipolar cautery provides better intraoperative visualization of laryngeal nerves. Intraoperative monitoring of the RLN with the NIM® (nerve integrity monitor—Xomed, Jacksonville, Florida) endotracheal tube may further reduce nerve injury, but the benefits of its usage have not been investigated adequately. Moreover, some of the earlier series may be biased toward thyroidectomy as a primary etiology for BVFI because they focused on the surgical repair of BVFI and not its etiology.

Our study found an increased role of malignancy as a cause of adult BVFI. This relates to longer survival times in patients with head, neck, and chest neoplasms, rather than an increase in the incidence of cancer. Accordingly, 93% (15/16) of malignancies causing BVFI represented recurrences (n = 12) or metastatic disease (n = 3) in our series. Only one case presented with BVFI secondary to a primary neoplasm. At Henry Ford Hospital, a review of 251 cases (159 UVFI and 92 BVFI) shows that nonlaryngeal malignancies, primarily pulmonary are the cause of UVFI in 25%, and 19% of BVFI.21 Any enlargement of mediastinal lymph nodes, thyroid

<table>
<thead>
<tr>
<th>Author</th>
<th>Year Pub</th>
<th>Total</th>
<th>Post Thyroidectomy</th>
<th>Malignancy</th>
<th>Traumatic</th>
<th>Neurologic</th>
<th>Idiopathic</th>
<th>Miscellaneous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clerf</td>
<td>1955</td>
<td>112</td>
<td>92.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>8.0</td>
</tr>
<tr>
<td>Williams</td>
<td>1959</td>
<td>26</td>
<td>61.6</td>
<td>15.4</td>
<td>3.8</td>
<td>0.0</td>
<td>15.4</td>
<td>3.8</td>
</tr>
<tr>
<td>Gorman &amp; Woodward</td>
<td>1965</td>
<td>25</td>
<td>76.0</td>
<td>0.0</td>
<td>8.0</td>
<td>0.0</td>
<td>4.0</td>
<td>12.0</td>
</tr>
<tr>
<td>Parnell &amp; Brandenburg</td>
<td>1970</td>
<td>14</td>
<td>78.6</td>
<td>7.1</td>
<td>0.0</td>
<td>14.3</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Whicker &amp; Devine</td>
<td>1972</td>
<td>161</td>
<td>96.3</td>
<td>0.0</td>
<td>1.2</td>
<td>1.9</td>
<td>0.6</td>
<td>0.0</td>
</tr>
<tr>
<td>Bulateau</td>
<td>1973</td>
<td>8</td>
<td>37.5</td>
<td>12.5</td>
<td>0.0</td>
<td>0.0</td>
<td>50.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Maisel &amp; Ogura</td>
<td>1974</td>
<td>54</td>
<td>40.7</td>
<td>7.4</td>
<td>31.5</td>
<td>7.4</td>
<td>3.7</td>
<td>9.3</td>
</tr>
<tr>
<td>Hol linger, et al.</td>
<td>1976</td>
<td>240</td>
<td>57.5</td>
<td>6.7</td>
<td>2.9</td>
<td>21.7</td>
<td>6.7</td>
<td>4.6</td>
</tr>
<tr>
<td>Tucker</td>
<td>1979</td>
<td>180</td>
<td>45.6</td>
<td>7.8</td>
<td>30.0</td>
<td>5.6</td>
<td>0.0</td>
<td>11.1</td>
</tr>
<tr>
<td>Kearsley</td>
<td>1981</td>
<td>20</td>
<td>35.0</td>
<td>40.0</td>
<td>0.0</td>
<td>15.0</td>
<td>10.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Henry Ford Hospital</td>
<td>1991</td>
<td>92</td>
<td>17.4</td>
<td>18.5</td>
<td>32.6</td>
<td>13.0</td>
<td>15.2</td>
<td>3.3</td>
</tr>
<tr>
<td>Jefferson Hospital</td>
<td>1999</td>
<td>75</td>
<td>10.7</td>
<td>21.3</td>
<td>26.7</td>
<td>18.7</td>
<td>13.3</td>
<td>9.3</td>
</tr>
</tbody>
</table>

| Total BVFI       | 1007     | 57.6  | 8.0    | 13.2   | 9.9    | 5.4    | 5.9    |
| Total BVFI Pre-1980 | 820   | 66.9  | 4.9    | 10.1   | 8.7    | 3.4    | 6.0    |
| Total BVFI Post-1980 | 187   | 16.6  | 21.9   | 26.7   | 15.5   | 13.9   | 5.3    |

or esophageal tissue, or direct invasion of the RLN as it ascends in the tracheoesophageal groove can cause nerve dysfunction and possibly paralysis.

Blunt and open trauma to the neck is more common today than in 1955 at the time of Clerf’s article, and more victims survive. Blunt trauma to the neck can cause mechanical airway obstruction as well as obstruction secondary to bilateral RLN paralysis. Trauma resulting from other cervical surgeries, such as carotid endarterectomy, anterior cervical fusion and cervical esophageal surgery may contribute to laryngeal nerve injury, but is less frequently bilateral. Trauma secondary to prolonged endotracheal tube intubation can cause BVFI. However, the most frequent clinical findings are subglottic or interarytenoid fibrosis and cricoarytenoid ankylosis. In the acute setting BVFI due to intubation can be caused by one of three entities: (1) Cricoarytenoid joint (CAJ) inflammation; (2) CAJ dislocation; or (3) RLN neuropraxia. Neuropraxia is believed to

Is there a difference in the etiology of UVFI versus BVFI? In comparing combined series of UVFI and BVFI from 1970 to 1991 (Figure 3), BVFI occurred much more commonly after thyroid surgery, whereas the most common cause of UVFI was extralaryngeal malignancy, occurring in greater than one-third of cases. Terris, in an aggregate study of 1,019 UVCP patients, found that neoplasms (200) and surgical trauma (139) were the most common etiologies.22

The paradoxical association of a relatively clear voice with varying degrees of respiratory obstruction can obscure the diagnosis of BVFI. Voice quality is often better in patients with BVFI than in patients with UVFI. Those suspected of laryngeal malfunction should be evaluated with a thorough history addressing questions of prior malignancy, constitutional symptoms, multiple intubations, prior thyroid surgery, vocal change, dysphagia, dyspnea, stridor, sleep disturbance, snoring, and neurologic complaints or disease. A complete physical should be performed, including neurologic examination and laryngeal examination, either indirect, flexible fiberoptic, or rigid as part of a stroboscopic evaluation. The complete evaluation of the patient with vocal fold immobility has been discussed thoroughly in many other articles.21–30

CONCLUSIONS

In comparison with previously published series, fewer cases of BVFI present today as a complication of thyroid surgery and more as the result of malignancies and nonsurgical trauma. As a higher percentage of BVFI is caused by malignancy, patient evaluation needs to be focused and timely in order to affect patient prognosis. Unfortunately, BVFI resulting from malignancy is not usually an initial sign of local disease, but an ominous sign of recurrence or metastases. In comparing UVFI and BVFI we found that thyroidectomy causes a higher percentage of BVFI than of UVFI. Over one-third of UVFI cases were caused by neoplasm (lung cancer in 50%), which further underscores the potential seriousness
of immobile vocal folds and the need for careful investigation.

REFERENCES