

Bilateral Vocal Fold Paresis and Multiple System Atrophy

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Objective: To review a case series of patients with systemic neurodegenerative disease presenting to a laryngologist for workup of dysphonia and found to have bilateral vocal fold paresis.

Design: Case series.

Setting: Tertiary care voice center.

Patients: Series of patients with neurodegenerative disorders examined for dysphonia.

Main Outcome Measures: History and physical examination including fiberoptic laryngoscopy were performed on all patients. Some patients underwent polysomnography.

Results: Seven patients during a 2-year period were noted to have bilateral abductor vocal fold paresis. Five of 7 (71%) had the diagnosis of multiple system atrophy proposed by the laryngologist. All 7 patients described sleep-disordered breathing with stridor.

Conclusions: Patients with systemic neurodegenerative disorders such as Parkinson disease should be examined for multiple system atrophy and for evidence of bilateral vocal fold paresis. Workup for stridor should include polysomnography. Treatment of glottic obstruction in these patients includes constant positive airway pressure at night or tracheotomy. The finding of bilateral vocal fold paresis can be life threatening.

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DYSPHONIA IS A well-known symptom of neurodegenerative diseases such as Parkinson disease (PD). With voice disorders occurring in approximately 90% of these patients,¹ many of them seek treatment of their dysphonia from a laryngologist. A careful evaluation by the laryngologist, however, may lead to a change in a patient's diagnosis as well as elicit further important findings that affect the patient's overall prognosis.

Multiple system atrophy (MSA) is a neurodegenerative disorder that has the characteristics of 3 major diseases: PD, olivopontocerebellar atrophy, and the Shy-Drager syndrome.² Parkinson disease is characterized by degeneration of the striatonigral tracts in the basal ganglia that results in a movement disorder distinguished by muscle rigidity, tremor, and bradykinesia. Parkinson disease is commonly an idiopathic disorder, but subtypes associated with illicit drug use also exist. Olivopontocerebellar atrophy is characterized by ataxia. Autonomic failure is the hallmark of Shy-Drager syndrome. Pa-

tients with this disorder are plagued by severe orthostatic hypotension, constipation, incontinence, and impotence.

Frequently, patients with MSA are not initially diagnosed correctly.² Indeed, MSA often initially develops as one of the subdisorders contained in the description. Patients may be treated for PD for several years, but then progression of symptoms and recalcitrance to medicines ultimately lead the practitioner to consider a diagnosis of MSA. While the diagnosis is firmly substantiated when the patient has symptoms from all 3 subdisorders, not all syndromes may be equally represented in a given patient: a single syndrome typically predominates (typically parkinsonism), leaving symptoms from the other syndromes less noticeable or debilitating. Once diagnosed, MSA portends a poor prognosis, with average life spans after diagnosis between 3 and 9 years.

Bilateral vocal fold paralysis has been recognized in patients with MSA.³⁻⁵ Described as a selective abductor paralysis or paresis, many patients are thought to ultimately die of respiratory failure as a result of glottic airway compromise. This is

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cursorily mentioned in a number of articles in neurologic journals but is seldom the focus of the manuscript.^{2,3,5,6} It has rarely been mentioned in American otolaryngologic literature and can be found in only a few reports from Europe and Asia.^{4,5,7} These reports describe patients with a variable bilateral abductor vocal fold paresis that is much worse during sleep. Sleep-disordered breathing similar to obstructive sleep apnea is noted, with the obstruction occurring at the level of the vocal folds. Patients often do not recognize the glottic disorder, and only from a careful history can this be discovered. Polysomnography demonstrates findings consistent with obstructive sleep apnea. Many patients require intervention such as continuous positive airway pressure support to prevent nighttime apnea. Some patients require tracheotomy to bypass the physiological obstruction.

We present our experience with 7 patients noted to have stridor only after a thorough history and physical examination for presumed voice disorder. These 7 patients with MSA and abductor vocal fold paresis were identified during the past 2 years in a busy tertiary center voice clinic. In 5 of these cases, our evaluation was the first to define the patients' disease as MSA. We report our recent experience with bilateral vocal fold paresis and MSA and review the literature.

REPORT OF CASES

CASE 1

A 64-year-old man had a 4-year history of parkinsonism and MSA. He had been treated for Parkinson hypophonia with Lee Silverman voice therapy as well as collagen augmentation of the vocal folds, with little improvement. During the past 2 years he developed stridor at night. Physical examination with videolaryngoscopy showed decreased vocal fold abduction and normal vocal fold adduction. The vocal folds were bowed at rest. He had no stridor while awake. Polysomnography was performed and showed obstructive sleep apnea with stridor. The patient was successfully treated with bilevel positive airway pressure. During the past year, he needed his bilevel positive airway pressure settings increased to maintain adequate nighttime ventilation.

CASE 2

A 50-year-old woman had a 2-year history of severe and progressive parkinsonism. Additional symptoms included dysautonomia (bladder incontinence and orthostatic hypotension) and cerebellar and pyramidal tract involvement. She came to our clinic for evaluation of hypophonia. At the time of evaluation, a history of stridor at night was elicited and examination demonstrated restricted abduction of the vocal folds bilaterally during inspiration. Her polysomnogram was positive for obstructive sleep apnea, and she was successfully treated with bilevel positive airway pressure at night. After discussion with her neurologist, her diagnosis was changed to MSA.



Bilateral vocal fold paralysis caused by multiple system atrophy. Also noted are changes consistent with reflux laryngitis. This is a 90° rigid telescopic view of the larynx in patient 3 during maximal glottic opening.

CASE 3

A 70-year-old man had a 2-year history of parkinsonism and MSA. He additionally had symptoms of autonomic dysfunction with orthostatic hypotension and urinary incontinence and frequency. He had severe tremor and ataxia. Before our evaluation, he underwent transurethral prostate resection for benign prostatic hypertrophy while under general anesthesia with oroendotracheal intubation. He was seen emergently 2 weeks later with a 24-hour history of severe dyspnea and biphasic stridor. Examination demonstrated a 1- to 2-mm glottic airway that was fixed during both inspiration and expiration. An emergent awake tracheotomy was performed shortly thereafter. Palpation of the arytenoids while the patient was under anesthesia demonstrated no evidence of scar fixation. Further history obtained after tracheotomy included nighttime stridor for the preceding several months. During the past year, he remained tracheotomy dependent and further developed dependence on nighttime artificial ventilatory assistance because of diaphragmatic hypoventilation. Results of vocal fold examination were essentially unchanged. A 90° rigid laryngeal telescopic photograph is shown in the **Figure**.

CASE 4

A 51-year-old man had a 1-year history of parkinsonism. He came from Canada for evaluation and treatment of Parkinson hypophonia. Symptoms of parkinsonism with tremor and hypophonia had been present for approximately 1 year. At the time of videolaryngoscopy he was noted to have impaired vocal fold abduction with near-normal adduction. Vocal fold bowing was also noted. Further history from the patient's spouse was significant for nighttime stridor. The patient denied any dyspnea. He was told of the findings and a polysomnogram was recommended. He returned to Canada for further treatment. Discussion with his neurologist led to changing his diagnosis to MSA.

CASE 5

A 72-year-old woman had a 3-year history of parkinsonism. She came to our clinic for evaluation and treatment of Parkinson hypophonia. Results of the physical examination showed impaired vocal fold abduction with normal adduction and vocal fold bowing. Further history disclosed autonomic dysfunction with urinary retention requiring intermittent self-catheterization, as well as orthostatic hypotension. Her spouse indicated that she had stridor at night. A polysomnogram with a trial of continuous positive airway pressure was recommended. Further discussion of this case with her neurologist led to a change in diagnosis to MSA.

CASE 6

A 48-year-old man had a 7-year history of progressive olivopontocerebellar atrophy. During the past several months, he had developed a weak voice and Parkinson-like symptoms of rigidity and bradykinesia, as well as progression of his ataxia. On questioning with his bed-partner present, it was found that he also had developed significant stridor while sleeping that, in fact, required him to sleep upright at times to avoid marked dyspnea. Office-based laryngoscopic examination showed a restricted glottic airway caused by impaired vocal fold abduction. Polysomnography was recommended, but the patient refused further diagnosis or treatment. He was informed of the possibility of future airway compromise but elected to avoid medical intervention. Discussion with his neurologist led to a change of his diagnosis to MSA.

CASE 7

A 79-year-old woman with PD complicated by autonomic dysfunction was examined for Parkinson hypophonia. She was essentially aphonic at the time of evaluation. Her family reported marked progression of the parkinsonism during the past year, despite maximal medication. Evaluation of the vocal folds with laryngoscopy showed poor abductor movement during inspiration. Further discussion with the family elicited a history of stridor and intermittent obstructive apnea. Polysomnography was planned. The patient was also seeking surgical alternatives for treatment of her rapidly progressive PD. This patient was also believed to have developed MSA.

COMMENT

Multiple system atrophy describes a neurodegenerative syndrome that combines symptoms and pathologic findings of 3 distinct neurologic diseases. These diseases are striatonigral degeneration (PD), olivopontocerebellar atrophy, and autonomic dysfunction (Shy-Drager syndrome).² Patients with MSA exhibit symptoms of parkinsonism, ataxia, and autonomic dysfunction. The symptoms vary from patient to patient, but tend to be more progressive than their single-syndrome counterparts. The constellation of symptoms is listed below.

- *Parkinsonism*: tremor, bradykinesia, rigidity, and gait disturbance.
- *Ataxia*: gait ataxia and vocal ataxia (mixed dysarthria).
- *Autonomic dysfunction*: orthostatic hypotension, dysphagia, constipation, fecal incontinence, urinary retention, urinary incontinence, impotence, hypohidrosis, hyperhidrosis, and thermoregulation abnormality.
- *Bilateral vocal cord paralysis*: sleep-related laryngeal stridor and respiratory distress.
- *Pyramidal dysfunction*: Babinski signs and hyperkinetic stretch reflexes.
- *Cognitive dysfunction*: reasoning deficit, learning deficit, memory deficit, and attention deficit.

Unlike their counterparts with isolated PD, patients with MSA present with their disease earlier and with a course that is rapidly progressive. Medicines are less effective than in those with PD alone. The life span of these patients after diagnosis is often less than 10 years, heralding the rapid degeneration of the affected central nervous system tracts.

In general, pathologic findings noted in brains of patients with MSA are not very different from those in patients with the individual syndromes.³ The findings, however, may be more extensive. Those with severe parkinsonism show degeneration in the substantia nigra of the putamen and globus pallidus. There is loss of dopaminergic neurons, but unlike PD, Lewy inclusion bodies are not ordinarily seen. Patients with prominent ataxia have loss of pontine nuclei and Purkinje cells in the cerebellum. In those with autonomic dysfunction, losses of both parasympathetic and sympathetic tracts are noted. There is loss of cells in the spinal cord tracts of the intermediolateral cell column. Loss of cells of the Onuf nucleus results in bowel and bladder dysfunction. The dorsal motor nucleus of the vagus nerve is affected, but autopsy examination of 2 patients who died of airway compromise and MSA failed to show pathologic changes in the nucleus ambiguus.³

Bilateral abductor vocal fold paralysis can be seen in MSA, often late in the disease. Indeed, a patient with MSA may present with vocal fold paralysis, and respiratory distress may be the initial symptom.^{4,5} Vocal fold paralysis may go unrecognized, as it presents insidiously and patients may develop some tolerance during its initial progression. Sleep-disordered breathing can be noted,⁶ but often this diagnosis may be delayed unless the patient has an alert bed partner. Symptoms include stridor at night as well as those seen in obstructive sleep apnea syndrome (memory loss, daytime somnolence, and short sleep latency). These patients with sleep-disordered breathing may respond positively to continuous positive airway pressure or bilevel positive airway pressure, as did our first 2 patients. Alternatively, tracheotomy has been recommended in patients with more severe symptoms.

Vocal fold findings are different from those in PD. In PD, glottic opening and closure is normal.^{8,9} Patients may exhibit vocal fold bowing, glottic incompetence, and open-phase configuration on videostroboscopy. These patients' speech is characterized by a weak and occasionally breathy voice. There may also be a vocal ataxia with scanning speech. In MSA, the vocal folds often do not

abduct past the paramedian position, but adduction may be normal. The vocal quality noted in our patients was consistent with Parkinson hypophonia. Kluin et al¹⁰ noted that patients with MSA may have a mixed dysarthria with hypokinetic, ataxic, and spastic components. The predominant type of dysarthria was consistent with the predominant neurodegenerative subtype present in each patient.

Histopathologic features of the intrinsic laryngeal muscles have been evaluated.^{3,7,11} In 3 patients, muscle fibers in the posterior cricoarytenoid (PCA) muscles were noted to be atrophied, while the laryngeal adductors were normal in size. Further examination in 1 patient noted lipofuscin deposition and necrosis of the sarcoplasmic reticulum in the PCA.³ Significant loss of cells in the nucleus ambiguus and loss of axons in the recurrent laryngeal nerves were not noted. Guindi et al⁷ showed both myopathic and neuropathic atrophy of the PCA in 2 additional patients. In a comparison study between PD and MSA, Isozaki et al¹¹ showed differences in histologic characteristics of laryngeal muscles. In the patients with PD, there is normal laryngeal muscle fiber number and density. Selective neurogenic atrophy was seen in the PCA muscle of the patients with MSA.

Isozaki et al¹² performed laryngeal electromyography in 5 patients with MSA. In this study, an esophageal surface electrode system was used to evaluate the PCA so that prolonged and nighttime monitoring could be performed. Monitoring of the laryngeal adductors was performed with percutaneous needle electrodes. Comparisons were made between the percutaneous technique and the esophageal technique to verify reliability. Results of the monitoring showed disordered contraction of the thyroarytenoid muscle in patients with MSA. Contraction of both the thyroarytenoid and PCA during inspiration was noted in 1 patient. Increased activity of the thyroarytenoid was noted during sleep in 2 patients. Activity of the PCA was noted to fade during sleep in the patients with MSA. These findings support the exacerbation of laryngeal obstruction during sleep as well as neurogenic atrophy of the PCA muscle in MSA.

Treatment of MSA is similar to that of PD, with dopamine agonists and occupational therapy.² Autonomic dysfunction can be treated with a variety of sympathetic and parasympathetic mimetics. Unfortunately, MSA tends to be more recalcitrant to treatment than PD. Those with vocal fold paralysis and minimal symptoms should undergo polysomnography and evaluation for continuous positive airway pressure or bilevel positive airway pressure therapy. Those with symptoms of airway obstruction should receive a tracheotomy to bypass the level of obstruction. Patients who have undergone tracheotomy

are rarely decannulated because of the progressive nature of the disease.

Although not currently considered part of the diagnostic criteria in MSA, our experience shows that presence of bilateral abductor laryngeal paresis can herald a decline in a patient's course. In this light, we consider the presence of bilateral abductor laryngeal palsy to be clinically pathognomonic for MSA, and in these patients we recommend reevaluation by their neurologist to confirm and treat them appropriately. This clinical finding may lead to collection of additional data to document potentially premonitory nighttime stridor unrecognized by the patient; in 5 of our patients, the diagnosis of MSA was recommended by the laryngologist. Although undiagnosed MSA represents a few patients who present to the otolaryngologist, one must be alert to its symptoms and findings. Early tracheotomy may prevent an untoward respiratory compromise in the patient with nighttime stridor.

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