Progressive Supranuclear Palsy – A Case Study from the Perspective of a Primary Care Physician Son

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Abstract
Progressive Supranuclear Palsy (PSP) is a rare geriatric pathology, from the abnormal deposition of the tau protein, combining the motor tremor and bradykinesia of Parkinson’s disease with the cognitive defects of Alzheimer’s disease. As physical and mental debilities progressively manifest in PSP, the physician, family, and patient face decisions on how to manage this terminal neurodegenerative disease. Physicians note the outcomes of decisions and often express, either to peers or internally to oneself, how they would handle a similar situation affecting their own family. In this case, we will explore PSP and examine a physician’s perspective as his father navigates his journey through it.

Introduction
Progressive Supranuclear Palsy (PSP), formerly known as Richardson Syndrome, was first discovered in 1964 by Steele, Richardson and Ozlenksy in Toronto.1-3 It primarily consists of generalized bradykinesia, frontotemporal dementia and a vertical gaze palsy.2,4,5 A rare pathology, it occurs in 5-6/100,000, usually diagnosed in the early sixties with an expected average duration of ten years.4,6 There is a minimal predilection for the male gender (55%) and it tends to favor the less educated.4
Because the symptoms initially are generalized and progress insidiously, it is confused with similar diagnoses of movement and cognitive disorders.4 Parkinson’s disease is the closest motoric analog to PSP, as they share the spectrum of effects of generalized bradykinesia. On a cognitive level, the frontal dementia of PSP most closely resembles Alzheimer’s.

As the disease progresses, family members have the burden of managing the obstacles of both physical and cognitive deterioration. A family’s support structure is most effective when it is multifactorial, allowing address of the changing demands of the course of PSP. When the family contains medical personnel, someone who has seen like cases in a detached role and has the blessing and burden of knowledge, decisions are reached in a different manner.

Case Presentation
At fifty-one, my father, a high-functioning civil engineer, was diagnosed with an essential tremor and treated with propranolol. Within four years, the stigmata of Parkinson’s disease developed. His bradykinesia, rigidity, intention tremor and postural hypotension continued to progress despite escalating doses of Sinemet (Carbidopa-levodopa), Mirapex (Pramipexole), and Symmetrel (Amantadine).
Symptoms were more difficult to control than expected, exacerbating significantly when compliance with the high dose regimen was relaxed even slightly. Fourteen years later, he was sent out of state for a deep brain stimulator (DBS) to stave off the worsening disease. He was declined for the procedure due to limited levodopa effect and profound Executive Disorder.
This noted cognitive defect soon led his new neurologist, the fourth such specialist to evaluate him, to the diagnosis of PSP. It became clear, after multiple questionable financial decisions by my father were discovered, that the dementia had insidiously been growing for years, but remained largely undiscovered because his intelligence allowed him to compensate. Visual and auditory hallucinations, usually centering around tiny bugs, were at first indulged but then briskly dismissed as the family’s patience eventually wore thin. As dementia deepened, paranoia blossomed creating conflict throughout the family as he became more violent. Gradually however, his functionality diminished and tasks, such as balancing the budget, shopping and driving, which he saw as his rights, were taken from him one by one.
Shortly after his sixty-sixth birthday, my father made his last trip out of the house. Falls from rigidity and discoordination made even the four stairs to the garage dangerous. Nine months later, he became bedfast. Hospice, along with insurance purchased years prior, allowed him to live at home with the aid of a part-time nurse to help my
mother in day-to-day care. His care was transferred to a family physician, who specialized in mobile medicine. Despite being confined to the bed, he received enjoyment from family, television, and his diet consisting heavily of ice cream and pie. Gradually, the joy and quality of life diminished, as his cognition declined and his aspiration worsened. Multiple times he became septic from recurrent pneumonias due to chronic aspiration, requiring oral antibiotics without hospitalization. While he would show some level of recovery, each pneumonia left him with a new diminished cognitive and functional baseline. Two months prior to turning sixty-eight, my father stopped eating in response to violent coughing from aspiration. Family transitioned him to complete palliative care, and he passed away at home with his family ten days later.

**Discussion**

Tauopathies are neurodegenerative conditions characterized by a pathologic accumulation of insoluble intraneuronal aggregates of tau proteins (Figure 1) leading to various frontotemporal dementias. Phosphoproteins that play a major role in stabilization of microtubules by polymerization, tau proteins are encoded on chromosome 17, have six isoforms and are important in both axonal transport and neuronal integrity. Created by an inversion with several superimposed deletions, dysfunction is caused by hyperphosphorylation and aggregation of the microtubule-association protein tau (MAPT) in white matter and depends upon anatomic area, cell type and specific isoform of tau deposits. In PSP, there is an increase ratio of 4 repeat tau/3 repeat tau, which affect the nigrostriatal dopaminergic pathway, cerebral cortex cholinergic pathway and serotoninergic receptors as well as the striatum and globus pallidus interna’s GABAergic function. Microscopically, the loss of neuronal cells, gliosis and atypical neurofibrillary tangles leads to macroscopic atrophy of the pre-frontal cortex, basal ganglia, cerebellum, mid-brain and to a lesser degree the spinal cord.

Besides clinical criteria, autopsy remains the gold standard for diagnosis; although, MRI will show signs of mid-brain atrophy with the “Hummingbird Sign” (Figure 2), and several tracers are being developed for PET Scan applications. Early in the disease, physical manifestations of PSP are most prominent. Studies demonstrate that not only do physical manifestations of PSP account for primary functional disability, but also all patients with early PSP have less than perfect Basic, ADL and Instrument Use scores. Primarily, the generalized bradykinesia causes postural instability, the first symptom in 81% of cases, contributing to the falls through gait and balance impairment. In fact, axial motor defects in PSP more greatly contribute to patient falls than do the motor defects in Parkinson’s. Ocular movement disorders occur next, nearly four years into the course, and consist of vertical gaze saccades, causing visual impairment and further inhibiting mobility. Urinary symptoms are experienced in 89% of PSP cases with urge and frequency being the most common maladies, although retention can occur if the tau deposits and subsequent atrophy affect the spinal cord. Other physical manifestations are tremor, constipation, dysphagia, dysarthria and apraxia. Sensory symptoms are not commonly experienced, although increased pain sensitivity can occur due to degeneration of the descending inhibitory control system within the brainstem.

Cognitive impairment is no less an important component of PSP. Frontal dementia, easily confused with Alzheimer’s because of the effect on spatial and recall memory, eventually invades 80% of cases,
although only a quarter experience it early in the course.²⁴ The standard MMSE is an insensitive tool for detecting this, further compromising early discovery.²⁴ This augments anger, disgust, sadness fear and surprise leading to depression and apathy.²⁴,¹² Furthermore, these patients have difficulty with social cognition, empathy, and the ability to perceive insincere communication, such as lying or sarcasm.⁴,¹³ Sleep can be affected with the presence of sleep apnea and REM sleep disorder.³,⁴ Treatment for PSP is symptomatic and multidisciplinary. Strength and stretch physical therapy (PT) has demonstrated a decrease in falls and a slower progression of bradykininesia, while Sinemet and Amantidine only have short-lived benefit⁴,⁶ and negatively augment the excessive daytime fatigue caused by the dysregulated sleep architecture.¹⁴ Gaze training may help visual dysfunction. Dementias are treated in the usual fashion.⁴ Dysphagia leads to aspiration, leaving the difficult decision of nutrition delivery. Enteral nutrition should not be contemplated unless motoric decline outpaces cognitive decline as percutaneous endoscopic gastrostomy (PEG) tubes do not improve long-term survival rates.⁴,¹⁵ While other countries utilize Hospice primarily for patients with cancer, the guiding palliative principles extrapolate well to the pain from rigidity, dyspnea and dysphagia seen in PSP¹⁶ and quality of life does improve with the multidisciplinary approach of a palliative care specialist in neurodegenerative diseases.¹⁷ Finally, advanced care planning early in the disease process, prior to the onset of dementia, should be a priority in PSP patients¹⁸, as future crises can be proactively managed in a manner consistent with patient and family desires.¹⁷

As our family navigated the unrelenting course of PSP, we watched my father be locked in both a physical and mental prison. PT was thwarted by his frustration and apathy. While the physical limitations were initially problematic, I found a certain peace when his immobility prevented him from continuously acting upon his paranoid dementia. Adopting the tenants of Hospice, we elected to allow him to experience activities he enjoyed despite the consequences. Enteral and parenteral feedings were never considered. The only life prolonging measure employed was antibiotics. The most valuable benefit gained of having a physician family member was that decisions were made proactively, and the family was allowed to feel it was acceptable to do nothing at times. In the end, he was allowed to slip away peacefully, without pain and with family close.

**Conclusion**

PSP is a rare condition which usually presents in the geriatric population with physical dysfunction that overlaps with Parkinson’s and dementia resembling Alzheimer’s. This combination creates a painfully slow decline for the patient and a frustrating course for family. Hospice is perfectly aligned to help and having medical personnel involved allowed for early intervention and maximal benefit.

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**References**