**Long-term deep brain stimulation for essential tremor: 12-year clinicopathologic follow up.**

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### METHODS - continued

- **Intracranial Electrode Impedances (ohms wrt case):**
  - Electrode 0: 1296/1126 6/16/2000
  - Electrode 1: 1285/1126 6/16/2000

- **Histopathological analysis of the thalami:**
  - Demonstrated fibrous sheaths lining the electrode tracts with thicknesses of 20 and 25 microns on the right and left, respectively. Fibrillary gliosis did not extend beyond 500 microns of the tissue-electrode interface. Reactive astrocytes, characterized by multiple long delicate processes highlighted with GFAP immunostaining, were found bilaterally within 1 mm of the tissue-electrode interface, more on the right. Numerous macrophages (KP-1 immunostain) and some multinucleated giant cells were found bilaterally.

### RESULTS - continued

- **Histopathological analysis of cerebellum:**
  - Large high power image demonstrates a "torpedo" (axonal spheroid), highlighted with neurofilament protein immunoreactivity. In the implanted thalamic sections, numerous mononuclear leukocytes, highlighted with leukocyte common antigen (LCA), were seen bilaterally. T lymphocytes (CD3 immunoreactive) were more frequently seen than B lymphocytes (L26 immunoreactive).
  - Axonal spheroids, hemorrhage, or perifocal edema were noted on H&E stained sections in the thalami. Patchy loss of cerebellar Purkinje cells was found, with "empty baskets", associated mild Bergmann's gliosis, occasional "torpedoes" (axonal spheroids of Purkinje cells), and occasional phosphorylated neurofilament protein immunoreactive Purkinje cells (Figure 2).

### CONCLUSIONS

1. This is the longest follow-up (12-years) of a patient implanted with DBS for PARKESWELL with postmortem examination and clinical-pathological correlation. The second longest reported follow-up after DBS implantation, reported in 2008, is 6 years.

2. Since this is a report of the second and last patient in our series, no neuropsychological analysis of the cerebellum was presented in this case.

3. The present case adds to the growing literature characterizing neuropathological findings in ET. This is the first case in which cerebellar pathology has been analyzed in an ET patient who has undergone DBS implantation.

4. Many aspects of ET, including clinical features, imaging studies, pathological findings, and DBS results point to the cerebellum as playing an important role in the pathophysiology of this disorder.

Despite the high prevalence of ET few patients have been studied at autopsy. Until recently, it was believed that there were no identifiable changes in the brains of patients with ET. Cerebellopathology, however, has recently been described in the brains of patients with ET [7, 8, 9]. In one of the largest clinical-pathological studies, involving 33 ET and 21 control brains, the major cerebellar pathological changes were found to include marked reduction in the number of Purkinje cells and a 7-fold increase in Purkinje cell torpedos [10].

The neuropathological findings in our case are consistent with the Lewy body negative cerebellar pathology in patients with ET. 6. The case also provides evidence of long-term efficacy and safety of VIM DBS.

### REFERENCES