Dense Core Vesicles around the Lewy Body in Incidental Parkinson’s Disease: an Electron Microscopic Study *

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Summary. In a case of Lewy body disease incidentally found at autopsy, numerous dense core vesicles, 80–200 nm in diameter, were seen in the neuronal perikarya of the locus caeruleus. They were particularly numerous in the vicinity of the Lewy bodies. The change seems to occur at the early stage of Lewy body production and may represent an additional morphologic clue to abnormal catecholamine metabolism in Parkinson’s disease.

Key words: Parkinson’s disease – Lewy body – Dense core vesicles – Electron microscopy

Introduction

Lewy bodies, or intracytoplasmic spherical inclusions in the pigmented neurons of the brain and sympathetic ganglia are commonly seen in Parkinson’s disease (Lewy, 1912; Greenfield and Bosanquet, 1953; Hartog Jager and Bethlem, 1960), although they also occur in non-parkinsonian individuals (Lipkin, 1959; Forno and Alvord, 1971; Thapedi et al., 1971). The body is hyaline, cosinophilic and often concentric when studied by light microscopy. Electron microscopically, the Lewy body is composed of fibrillary and granular materials. While the fibrils are arranged loosely and radially in the outer zone, the central core is composed of densely gathered circular profiles (Duffy and Tennyson, 1965; Roy and Wolman, 1969; Schochet, 1972; Forno and Norville, 1976). In spite of many elaborate morphological studies, the origin of the Lewy body is still unknown. Histochemically, the body may be protein in nature (Lipkin, 1959). It is generally considered that the Lewy body may be the result of a degenerative process unique to the melanin-containing neurons. In this communication, we report an occurrence of numerous dense core vesicles concomitant with Lewy bodies in a case with Forno’s incidental Lewy body disease (Forno, 1969).

Case History

The patient was a 72 year old man who developed, insidiously and progressively, a right hemiparesis, forgetfulness and disorientation about 12 months before his death. Through a left frontal craniotomy, a left parasagittal meningioma (3 x 2 x 1 cm), was totally excised. The hemiparesis improved within 3 weeks after the operation, however, his mental confusion remained unchanged. He died of an acute pulmonary embolus 9 weeks after the operation. Throughout the course of his illness, the typical parkinsonian symptoms, such as tremor, rigidity, and hypokinesia were not seen.

Gross and Light Microscopic Findings

The brain weighed 1450 g. There was a lesion of focal necrosis measuring 5 x 3 x 1 cm located in the left median frontal cortex 2 cm dorsal from the genu of the corpus callosum. This lesion was attributed to the previously removed meningioma. The substantia nigra and locus caeruleus were normally pigmented on gross examination. Histologically, the substantia nigra showed normal cytarchitecture except for a few neuronal cells which contained Lewy bodies. In the locus caeruleus bilaterally, there were many neurons containing Lewy bodies. For instance, in a single section cut horizontally at the upper pons, 16 out of 104 pigmented nerve cells contained from 1 to 4 Lewy bodies. There was no evidence of nerve cell loss or astroglial proliferation. The dorsal motor vagus nucleus showed no significant alterations.

Electron Microscopic Study

For this study, the locus caeruleus was taken from the formalin-fixed brain. Under the electron microscope, 20 Lewy bodies with characteristic granular and filamentous structures were identified. They were all associated with various numbers of dense core vesicles (Fig.1). These vesicles were mostly located at the outer margin of the outer zone of the Lewy body where radiating filaments intermingled with other cyto-
Fig. 1
Numerous dense core vesicles at the margin and in the outer zone (OZ) of a Lewy body. The circular profiles of the central core (CC) are smaller and lighter than the dense core vesicles. × 36000

Fig. 2
The dense core vesicles measure 80 to 200 nm in diameter and are composed of osmiophilic granular materials surrounded by a limiting membrane. × 67 500

plasmic organelles. Some vesicles were, however, also scattered throughout the perinuclear cytoplasm. The vesicles were of various sizes ranging from 80–200 nm in diameter and composed of osmiophilic granular materials surrounded by a limiting membrane (Fig. 2). In the neuronal cytoplasm, there were abundant mitochondria, rough ER, Golgi complexes, neuromelanin and neurofilaments surrounding the Lewy bodies. Detailed study of these organelles was difficult due to postmortem autolysis. As controls,