Detection of apoptosis in human brainstem by TUNEL assay

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SUMMARY

The aim of the present study was to evaluate the distribution of apoptotic neurons in the nuclei of the brainstem. Apoptosis was studied by the terminal deoxynucleotidyl transferase-mediated dUTP nick end-labeling (TUNEL) assay, in human brainstems taken at autopsy from 15 adults (age range: 25-58 years). The nuclei examined included the hypoglossal nucleus (XII), dorsal motor nucleus of the vagus (DMNV), solitary tract nucleus (STN), vestibular nucleus (Ve), cuneate nucleus (Cu), nucleus of the spinal trigeminal tract (NSTT), principal inferior olivary nucleus (PION), medial inferior olivary nucleus (MION) and dorsal inferior olivary nucleus (DION). For each nucleus, the apoptotic index was expressed as the percentage of TUNEL-positive neurons out of the total number of neurons counted. Statistical analysis was performed with one-way ANOVA and Student-Newman-Keuls test for multiple comparisons.

One-way ANOVA revealed that the differences in apoptotic index among the nuclei were statistically significant ($P<0.001$). Cu had the highest index, corresponding to 29.5±14.2%. The Student-Newman-Keuls test revealed significant differences when this value was compared with those of XII (14.1±12.0%; $P<0.05$), PION (12.8±13.8%; $P<0.01$), DION (12.0±12.4%; $P<0.01$), MION (12.0±15.7%; $P<0.01$), STN (8.5±11.9%; $P<0.001$) and DMNV (5.4±6.8%; $P<0.001$). The differences in apoptotic index between Cu and NSTT (27.1±18.1%) and between Cu and Ve (23.7±12.6%) were not statistically significant ($P>0.05$). The apoptotic index in the NSTT was higher than in DMNV ($P<0.001$), STN ($P<0.01$) and nuclei of the inferior olivary complex ($P<0.05$). Ve showed a higher apoptotic index with respect to DMNV ($P<0.01$) and STN ($P<0.05$). Apoptotic processes found in the brainstems were ascribed to hypoxic-ischemic injury, and heterogeneity in apoptotic index among the nuclei supports the hypothesis of the differing vulnerability of the nuclei of the brainstem.