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Abstract

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A Stereological Study of the Dopaminergic Innervation and its Targets in the Human Amygdaloid complex

Joint with L. Prensa

The amygdaloid complex (AC) is associated with the perception of fear and consequent anxiety related behaviors. Each AC nuclear group has particular internal and external networks and encodes different aspects of fear. Dopamine exerts its action either directly over the AC pyramidal projection neurons or by modulating the nonpyramidal interneurons (IN) which, in turn, modulate the output neurons. The activity of parvalbumin (PV) and calretinin (CR) positive (+) GABAergic IN populations is strongly affected by dopaminergic (DA) inputs. To elucidate the mechanisms of DA modulation in humans we investigate the DA innervation and its relation with the neuronal types in all AC territory. For that purpose the following studies were performed in every AC nuclear groups, nuclei and nuclear subdivisions: (1) stereological quantification of absolute number (using the optical fractionator) and density of neurons and glia; (2) stereological estimation of absolute number (using the optical fractionator) and density of the PV+ and CR+ IN, calculating the proportion of these IN with respect to the total neurons; (3) stereological quantification of the dopamine transporter (DAT)+ axon absolute length and density (using the isotropic virtual planes), and ratio between length of axon and neuron number; (4) confocal microscopy analysis of contacts between DAT+ axons and PV+ and CR+ IN. There is selective DAT+ innervation in the human AC, being in the central nucleus (main output station) twofold greater than in the basolateral group (main entrance structure). The distribution of CR+ and PV+ IN is heterogeneous and the percentage of CR+ IN with respect to the total neurons outnumbered that of the PV+ IN (13.30% for CR and 0.26% for PV; mean AC). Contacts between DAT+ axons and PV+ or CR+ IN were scant, suggesting that neither of the two IN populations is their main target. Determining the distribution, quantities, and postsynaptic targets of the DA terminals is needed to understand dopamine neuromodulation in the AC.

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