

The human nucleus accumbens - anatomical and MRI study

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The Nucleus Accumbens (Acc) is a poorly known structure of the human brain. Its existence as an individualized entity is polemical and it doesn't even have its own designation in the Portuguese Nomina Anatomica. It is supposed to correspond to a major part of the Basal Forebrain and to be the most prominent component of the Ventral Striatum that integrates the limbic and cortical-striatal-pallidal-thalamic-cortical circuits, acting as a motor-limbic interface. It is involved in several cognitive, emotional and psychomotor functions, frequently disturbed in neuropsychiatric disorders such as Alzheimer's and Parkinson's disease, Depression, Schizophrenia, Obsessive Compulsive Disorder (OCD) and addiction behaviors. Many studies concerning the Acc were made in animals (rodents, primates) but those performed in humans are not precise and are contradictory. On the other hand, the modern Magnetic Resonance Imaging (MRI) does not allow its clear identification and exact delimitation. Nevertheless some clinical studies have revealed the benefits its neurosurgical inactivation (by Thermocoagulation or Neurostimulation) in some of those disorders. It is therefore very important to study in the Acc accurate localization, to trace its precise limits and 3-D coordinates (stereotactic), and to perform the correspondent study on MRI in order to render the Acc a safe target for stereotactic procedures. These were the objectives of this study. Methods: Anatomical and MRI (3T) coronal serial slicing of 24 Acc from human cadaver brains were performed perpendicular to the AC-PC line and to the midline at referenced levels; the Acc contours were traced, and its dimensions and 3-D stereotactic coordinates measured on every slice. Twenty Acc were studied by the anatomical method, 14 by MRI and 12 by both methods. The Acc was identified as a distinct brain structure in the caudate-putamen transition, between the rostral limit of the lateral ventricle and the AC. Only the posterior half of this structure has clear-cut limits. The dimensions of this part of the Acc (mean values \pm SD) are: length 10.5 ± 0.7 mm, width 14.5 ± 1.6 mm and height 7.0 ± 0.8 mm. The mean stereotactic coordinates of its borders are: $Y = 0$ $Y' = 11$; $X = 3.7$ $X' = 15.1$; $Z = 2.2$ $Z' = -10.2$. These 3D coordinates are applicable to MRI. It was possible to identify, anatomically and by MRI, the Human Nucleus Accumbens as a distinct brain structure, to trace its limits and to establish its 3-D stereotactic coordinates.