DINAMICS OF INDICATORS OF THE HUMAN CEREBELLAR CORTEX AT THE STAGES OF POSTNATAL ONTOGENESIS

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The comparative analysis of thickness of the cerebellar cortex of people of both sexes, different ages. The main research method was morphometry of histologic specimen of cerebellum. It was found that thickness of the cortex cerebelli depends on the person's age, and its indicators uniformly decrease from the second period of adulthood to senium.

Keywords: cerebellar cortex, age periods, postnatal ontogenesis

Cerebellum as part of the nervous system has a large number of cellular and functional reserves. It is generally accepted that only a small percentage of neurons in the cerebellum are always active. A significant number of neurons and glial cells is functionally spare and its structural and functional activity increases by the action of various extreme factors. The need for in-depth research of age variation of thickness of the cerebellar cortex – the cause of our research.

The purpose of the research: is to make the comparative analysis of thickness of the cortex cerebelli at various stages of postnatal ontogenesis. The Research is based on an analysis of the results of craniometric, histologic and morphometric study of 268 corpses (males and females, aged 17 to 86 years). Research objects (208 corpses) were divided into five groups according to age periodization of human ontogenesis, adopted by the Seventh All-Union Conference on morphology, physiology and biochemistry APS the USSR (Moscow, 1965) to identify patterns of age-related changes of the cerebellar cortex. Criteria of research objects: Fatal abdominal or/and chest injury (and absence of head injuries); medical history of deceased, excluding the pathology of central or peripheral nervous system; death was no more than 24–36 hours ago; storage of corpses in the same conditions at a temperature +2 °C. Length and width of the skull were measured and craniotype was determined by value of the cranial index. Our research objects are mesaticephalic (medium-headed) with cranial (cephalic) index 75,0–79,9.

Materials and methods of research

It found that the lateral area is the most damageable part of the cerebellum. In this area dysfunction of Purkinje cells and increasing the number of atypical neurons begins earlier and more intensely. Therefore tissue of this area was taken for research (superior semilunar lobe of both hemispheres of the cerebellum). Biomaterial was fixed in 10% neutral formalin solution, was dehydrated in alcohols of increasing concentration, and was paraffin-embedded to make a 5-micron-thick histologic specimen. Tissue sections were stained with H&E, by Van Gieson's method. Sections were stained by Nissl method to examine basophil substance, chromatin, neuron's nucleoli. Some tissue sections were stained by Hekvist's method or Gross-Bilshovsky method to examine neurofibrils, dendrites and an axon. Stained Hystologic specimens were viewed by ×60, ×150, ×600 magnification using a CAM V200 «Micros Handelsgesellschaft m.b.H.» microscope camera. Results were processed using dedicated software Bio Vision 4.0 version. Microsoft Excel «Biostat» was used for statistical research.

Results of research and their discussion

Branched sulcuses filled with elements of the pia mater, and gyruses with gray matter on the surface were viewed by microscope. Gyrus' White matter is nerve fibers and glial cells. Three layers of the cerebellar cortex were viewed: an external molecular layer, a middle ganglionic layer and an internal granular layer. Cells of the molecular layer were located at a great distance from each other. Nucleoli of the granular layer cells visualized very clearly. Purkinje cells of the middle ganglionic layer were placed strictly in a row. Neuronal processes poorly visualized by H&E staining.

Thickness of the right cerebellar hemisphere cortex of male corpses was: 667,47 ± 17,70 micron during the adolescence, 666,45 ± 16,72 micron during the first period of adulthood, 623,09 ± 15,51 micron during the second period of adulthood, 591,88 ± 18,72 micron during the advanced age, and 536,70 ± 13,87 micron during the senium. Thickness of the right cerebellar hemisphere cortex of female corpses was: 661,79 ± 17,97 micron during the adolescence, 659,86 ± 16,33 micron during the first period of adulthood, 615,74 ± 18,13 micron during the second period of adulthood, 588,10 ± 19,68 micron during the advanced age, and 525,28 ± 12,70 micron during the senium. The maximum thickness of the right cerebellar cortex (796 micron in men and 792 micron in women) was identified in the

adolescence. The minimal thickness of the cerebellar cortex (434 micron in men and 433 micron in women) was identified in the senium.

Thickness of the left cerebellar hemisphere cortex of male corpses was: 665,26 ± 17,65 micron during the adolescence, 663,55 ± 16,81 micron during the first period of adulthood, 618,65 ± 15,39 micron during the second period of adulthood, 588,76 ± 18,66 micron during the advanced age, and 533,35 ± 13,84 micron during the senium. Thickness of the left cerebellar hemisphere cortex of female corpses was: 659,42 ± 17,91 micron during the adolescence, 657,05 ± 16,31 micron during the first period of adulthood, 611,61 ± 16,59 micron during the second period of adulthood, 584,10 ± 19,69 micron during the advanced age, and 521,17 ± 12,62 micron during the senium. The maximum thickness of the left cerebellar cortex (790 micron in men and 787 micron in women) was identified in the adolescence. The minimal thickness of the left cerebellar cortex (428 micron in men and 428 micron in women) was identified in the senium.

Conclusion

Research of quantitative changes in thickness of cortex cerebelli may be used as a basis for identifying patterns of age anatomy of the cerebellum (age involution). We assume that degeneration of the cerebellar cortex fibers is the reason of involution. Known, that male cerebellum is larger than female one. Scientists attribute this to the difference between the size of the skull. We found that thickness of the male cerebellar cortex is more than thickness of female cerebellar cortex. We observed hemispheric asymmetry of the thickness of the cerebellar cortex in all age periods with greater thickness in the right hemisphere. Scientists and researchers point out that the hemispheric asymmetry is at the heart of work of the entire brain. In this way, all these thickness parameters of the cerebellar cortex will be used as indicators of the norm in diagnostic and medical work.

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