THE PARAMETERS OF CEREBELLAR CORTEX AT THE STAGES OF POSTNATAL ONTOGENESIS AND IN ALCOHOLISM

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Abstract: the comparative analysis of thickness of the cerebellar cortex of people of both sexes, different ages and people with alcoholism was held. 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. The thickness parameters of the cerebellar cortex of people with alcoholism are similar to parameters of the cortex cerebelli of elderlies that hasn't misuse alcohol.

Keywords: cerebellar cortex, age periods, postnatal ontogenesis, alcoholic disease.

Introduction. 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.

Alcohol as an extreme factor can have an adverse effect on the organism. In some cases, the organism compensates for its action at the expense of available reserves, in other cases there is adaptive restructuring. It is known that chronic alcohol intoxication causes severe functional and morphological changes in human body and especially in organs of the nervous system. The need for in-depth research of age variation of thickness of the cerebellar cortex, and the lack of published data about its parameters in alcoholic disease – 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 and in chronic alcohol intoxication.

Materials and methods. 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. The ratio of research objects is presented in the following table.

Distribution of research objects by sex and age periods (n=208)

№	Age period		Sex		Total
			male	female	
1	Adolescence (n=38)	Abs. numb.	18	17	35
		%	16,67%	17%	16,83%
2	First period of adulthood (n=44)	Abs. numb.	22	21	43
		%	20,37%	21%	20,68%
3	Second period of adulthood (n=49)	Abs. numb.	25	23	48
		%	23,15%	23%	23,07%
4	Advanced age (n=46)	Abs. numb.	24	21	45
		%	22,22%	21%	21,63%
5	Senium (n=40)	Abs. numb.	19	18	37
		%	17,59%	18%	17,79%
Result		Abs. numb.	108	100	208
		%	51,92%	48,08%	100%

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 +2C.

The Sixth research group includes 60 objects (31 males and 29 females, aged 22 to 35 years old, alcohol abuse for 12-16 years) who died from effects of chronic alcohol intoxication.

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.

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, 600x 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.

Research results. 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 right cerebellar hemisphere cortex of men who died from chronic alcohol intoxication during the first period of adulthood was 593,75±16,49 micron. This indicator corresponds to indicators of cerebellar cortex of men who has not misuse alcohol and died during the senium. The thickness of the cerebellar cortex of women who died from chronic alcohol intoxication during the same period was 590,89±16,36 micron. This indicator also corresponds to indicators of senium people that has not misuse alcohol.

Maximum thickness of the right cerebellar hemisphere cortex of men with alcoholic disease is 740 micron, the minimum is 443 micron. Maximum thickness of the right cerebellar hemisphere cortex of women with alcoholic disease is 733 micron, the minimum is 441 micron.

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.

Thickness of the left cerebellar hemisphere cortex of men who died from chronic alcohol intoxication during the first period of adulthood was 590,41±16,53 micron. This indicator corresponds to indicators of cerebellar cortex of men who has not misuse alcohol and died during the senium. The thickness of the left cerebellar cortex of women who died from chronic alcohol intoxication during the same period was 587,39±16,45 micron. This indicator also corresponds to indicators of senium people that has not misuse alcohol.

Maximum thickness of the left cerebellar hemisphere cortex of men with alcoholic disease is 736 micron, the minimum is 493 micron. Maximum thickness of the left cerebellar hemisphere cortex of women with alcoholic disease is 730 micron, the minimum is 438 micron.

Discussion of the results. 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.

Thickness parameters of the cortex of both cerebellar hemispheres in people with alcoholism are similar to thickness parameters of the cerebellar cortex of senium people that has not misuse alcohol.

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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