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ZYGMENT URBANOWICZ

The posterior cord of the brachial plexus in man

Pęczek tylny splotu ramiennego u człowieka

The literature which discusses morphology of the posterior cord in man is not very copious (2, 3). Publications concerning its internal structure are not known. The purpose of the present work was to determine thickness of the posterior cord, as well as the number of fascicles, their size, and the index of their cross-section area in the course of postnatal life in man.

The study was done on 208 posterior cords taken bilaterally from cadavers of 52 males (M) and 52 females (F), who died at the age from 1 st day to 87 th year of life. They were free from any nervous system diseases. The material was divided into six age groups. Group I included 10 M and 10 F up to 1 st year of life, group II – 10 M and 10 F between 1 st and 14 th year, group III 6 M and 6 F between 15 th and 22 nd year, group IV – 10 M and 10 F between 23 nd and 40 th year, group V – 10 M and 10 F between 41 st and 60 th year, group VI – 6 M and 6 F above 60 th year of life. The methods used to obtain the material, to stain the slides and determine the thickness of the examined parts of the peripheral nervous system, the number of fascicles, the size, the index of their cross-section area were described in the previous papers (9, 10).

RESULTS

The posterior cord was present in all the cases. It was formed by the junction of three roots which were the posterior divisions of the upper, middle and lower trunks.

THICKNESS OF THE POSTERIOR CORD

The size of the cross-section area of the posterior cord ranged between 2.624 and 25.771 sq mm. The discussed value was similar on both sides of one body in 11.5%, it was greater on the right side in 51.0% and greater on the left side in 37.5% of the cases. The thickness of the posterior cord compared with the sum of the cross-section area of its three roots was similar in 10.6%, greater in 35.6% and smaller in 53.8% of the cases. The average thickness was (in sq mm) 13.439 [on the right side (r) 13.600, on the left side (l) 13.279, in males (M) 13.716, in females (F) 13.163]. In the age groups it was: 5.216 in group I, 9.316 in group II, 15.897 in group III, 16.910 in group IV, 17.591 in group V and 18.854 in group VI.

NUMBER OF FASCICLES

The examined part of the posterior cord was composed of 3 to 52 fascicles. There were 3 to 10 fascicles in 7.7%, from 11 to 15 in 15.9%, from 16 to 20 in 23.6% from 21 to 25 in 24.0% and more than 25 fascicles in 28.8% of the cases. The same number of fascicles on both sides of one body was found in 7.7%, the greater number on the right side appeared in 48.1%, and on the left side in 44.2% of the cases. The number of fascicles of the posterior cord compared to the sum of the fascicles number in its roots was equal in 3.0%, greater in 83.3% and smaller in 13.7% of the cases.

The average number of fascicles was 21.8 (r – 22.2, l – 21.4, M – 19.8, F – 23.7). In the age groups it was the following: 20.0 in group I, 20.5 in group II, 23.3 in group III, 22.1 in group IV, 23.3 in group V, and 22.4 in group VI.

DIMENSION OF THE CROSS-SECTION AREA OF FASCICLES

The thickness of individual fascicles ranged from 0.001 to 10.108 sq mm. Five groups of fascicles were distinguished as described in the previous paper (10). Very thin fascicles (vtn) formed 32.2% (r – 33.7%, l – 30.69%, M – 30.38%, F – 33.7%), thin fascicles (tn) – 34.8% (r – 35.2%, l – 34.3%, M – 32.8%, F – 36.3%), medium-thick fascicles (mtk) – 14.8% (r – 14.1%, l – 15.7%, M – 15.2%, F – 14.6%), thick fascicles (tk) – 11.9% (r – 19.8%, l – 13.1%, M – 13.9%, F – 10.3%), and very thick fascicles (vtk) – 6.3% (r – 6.3%, l – 6.3%, M – 7.6%, F – 5.0%) of all fascicles.

The frequency of occurrence of fascicles of different size in the discussed material was unequal in the age groups: in group I – vtn – 56.3%, tn – 32.5%, mtk – 6.6%, tk – 3.2% and vtk 1.4%; in group II it was 37.1%, 38.1%, 11.9%, 7.8% and 5.0%, in group III – 27.2%, 32.4%, 18.6%, 14.3% and 7.5%, in group IV – 23.1%, 33.7%, 16.4%, 18.3% and 8.5%, in group V – 24.5%, 35.9%, 17.4.5%, 19.9% and 8.3%, in group VI – 22.1%, 35.2%, 20.7%, 14.7% and 7.3% respectively.

The size of the cross-section area of all fascicles forming the posterior cord ranged from 1.399 to 14.753 sq mm. It showed similar values on both sides of one body in 10.6%, greater on the right side in 42.3%, and greater on the left side in 47.1% of the cases. The sum of thickness of fascicles of the posterior cord compared with the respective sum of its roots was similar in 6.8%, greater in 20.5% and smaller in 72.7% of the cases.

The average value of the cross-section area of fascicles of the posterior cord equalled (in sq mm) 7.328 ($r = 7.298$, $l = 7.359$, $M = 7.458$, $F = 7.199$). It was different in the age groups: 3.114 in group I, 5.623 in group II, 8.692 in group III, 9.495 in group IV, 9.248 in group V and 9.023 in group VI.

INDEX OF THE CROSS-SECTION AREA OF FASCICLES (IAF)

The value of the index of the fascicles' area ranged between 30.7 and 76.23. It was similar on both sides of the single body in 12.5%, greater on the right side in 30.8% and greater on the left side in 56.7% of the cases. The mean value of IAF equalled 54.5 ($r = 53.7$, $l = 55.4$, $M = 54.4\%$, $F = 54.7\%$). In the age groups it was the following: 59.7 in group I, 60.4 in group II, 54.7 in group III, 56.2 in group IV, 52.6 in group V and 47.9 in group VI.

DISCUSSION

The studies performed showed that the thickness of the posterior cord, number of fascicles, size of the cross-section area of fascicles and index of fascicles' area were different not only in persons belonging to the same age group and being of the same body height and similar body weight, but also in the same person on both sides of the body. These observations confirmed the reports of numerous authors concerning the internal structure of different nerves (1,4-11). The similar values of four or three features mentioned above were not found on both sides of one body, and for two features were observed only in 4.8%. Similar values of a single feature on both sides of one body were also found rather seldom: the thickness of the cord in 8.7%, the size of the cross-section area of fascicles (csaf) in 7.7%, the number of fascicles in 3.8% and IAF in 12.5% of the cases.

The examined features were greater in a single person on the right than on the left side: thickness in 51.0%, csaf in 42.3%, fascicles number in 48.1% and IAF in 30.8%. They were greater on the left side in 37.5%, 47.1%, 44.2% and 56.7% of the cases respectively.

The mean values of the examined features, with the exception of the size of the cross-section area of fascicles, were different on the sides of a single body. They were greater on the right than on the left side: the thickness by 2.4%, the number of fascicles by 3.7%. On the contrary, the mean value of IAF was greater on the left than on the right side by 3.2%. They also showed, with the exception of IAF, the differences related to sex. In males the thickness of the cord was greater by 4.2%, and the cross-section area of fascicles by 3.6% than in females. On the contrary, in females the number of fascicles was greater by 19.7% than in males.

Unequal percentage participation of differently thick fascicles in the posterior cord was observed in relation to the side of the body and sex. Very thin and thin fascicles occurred more often on the right than on the left side, while medium-thick and thick fascicles more often on the left than on the right side. Very thick fascicles were observed equally on both sides of the body. Very thin and thin fascicles appeared more often in females than in males. Medium-thick, thick and very thick fascicles were found more often in males than in females.

The examined features of the posterior cord were undergoing big changes during postnatal life. The thickness increased 3.6 times, the size of cross section area of fascicles – 3 times, and the number of fascicles by 16.5%, but IAF decreased by 19.8%. The participation of fascicles of different thickness in the cord structure changed in this period too: the occurrence of very thin fascicles decreased over 2.5 times, and the share of medium-thick, thick and very thick fascicles increased 3.8 times. The observed changes appeared mostly in the age group up to 22 nd year of life.

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STRESZCZENIE

Badania przeprowadzone obustronnie na zwłokach 104 osób wykazały stałą obecność pęczka tylnego, który we wszystkich przypadkach powstawał z połączenia 3 korzeni. Przeciętne wartości cech pęczka tylnego większe po prawej niż po lewej stronie były: grubość o 2,4% i liczba pęczków (1p) o 3,7%, a po lewej stronie był większy niż po prawej wskaźnik powierzchni pęczków (wpp) o 3,2%, natomiast wielkość powierzchni poprzecznego przekroju pęczków (pppp) miała podobne wartości po obu stronach ciała. W życiu pozapłodowym powiększały się: grubość pęczka tylnego 3,6 razy, wielkość pppp 3 razy, 1p o 16,5%, natomiast wpp zmniejszał się o 19,8%.

