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*Terminal Divisions of the Lateral Cord of the Brachial
Plexus in Man*

Końcowe części pęczka bocznego spłotu ramiennego u człowieka

In consequence of the division of the lateral cord to lateral and medial parts the musculocutaneous nerve and the lateral root of the median nerve arise. The author has not found any information about the existence of differences in the internal structure of these two parts, in the literature. This is the reason why the author decided to investigate the thickness of the lateral and medial divisions of the lateral cord, the number of fascicles, the size and the index of their cross-section area.

The studies were carried out on the material obtained bilaterally from cadavers of 43 males (♂) and 43 females (♀) who died between 1st day and 87th year of life. Six age groups were distinguished. Group I contained 8 ♂ and 8 ♀ up to 1 year of life, group II — 9 ♂ and 9 ♀ between 1st and 14th year of life, group III — 6 ♂ and 6 ♀ between 15th and 22nd year of life, group IV — 8 ♂ and 5 ♀ between 23rd and 40th year of life, group V — 6 ♂ and 9 ♀ between 41st and 60th year of life, and group VI — 6 ♂ and 6 ♀ above 60th year of life. The methods used to obtain and fix the material, to stain the slides and to determine the thickness of different parts of peripheral nervous system, the size of cross-section area of fascicles, the number of fascicles and the index of the fascicle's area, were described in previous publications (13, 14).

RESULTS

The studies were carried out on 172 lateral cords which splitted into two terminal divisions, lateral and medial. The lateral division made the musculocutaneous nerve (mc), the medial division made the lateral root of the median nerve (rlm).

THICKNESS OF LATERAL AND MEDIAL DIVISIONS OF LATERAL CORD

The value of the cross-section area of mc ranged between 0.386 and 6.544 sq mm, and of rlm between 0.586 and 11.960 sq mm. It was similar on both sides of a single body in 9.3% both in the lateral and in the medial division. The discussed value was greater on the right side in 43.0% in the lateral part and in 50.0% in the medial part, and it was greater on the left side in 47.7% and 40.7% respectively. The thickness of both divisions of the lateral cord was similar in 4.7%, the thickness of rlm was greater in 85.4%, and the thickness of mc was greater in 9.9% of the cases.

The average thickness of mc equalled (in sq mm) 2.507 [on the right side (r) 2.445, on the left side (l) 2.568, in males (♂) 2.411, in females (♀) 2.602], of rlm 4.582 (r — 4.633, l — 4.530, ♂ — 4.461, ♀ — 4.702). The values mentioned above in the age groups came out to be: in group I — 0.968 and 1.696, in group II — 1.937 and 3.037, in group III — 3.022 and 5.975, in group IV — 3.266 and 6.413, in group V — 3.210 and 5.586, in group VI — 3.198 and 6.112 respectively.

NUMBER OF FASCICLES

The lateral division was composed of 1 to 14 fascicles, and the medial division was composed of 1 to 23 fascicles. There were observed 1 to 5 fascicles in 67.4% in the lateral division, and in 22.7% in the medial division, from 6 to 10 fascicles were found respectively in 27.9% and 50.0%, from 11 to 15 fascicles in 4.7% and 19.2%, and more than 15 fascicles in 8.1% only in the medial division. The same number of fascicles on both sides of one body was found in 12.8% in the lateral division and in 10.5% in the medial division. The number of fascicles was greater on the right side of the body in 47.7% and 45.3%, and it was greater on the left side in 39.5% and 44.2% of the cases respectively. The number of fascicles was the same in both divisions in 7.0%, the greater number in the lateral division in 19.7%, and in the medial division in 73.3% of the cases.

The mean number of fascicles in mc equalled 4.6 (r — 4.9, l — 4.4, ♂ — 4.2, ♀ — 5.1), and in rlm 8.6 (r — 8.6, l — 8.7, ♂ — 8.1, ♀ — 9.1).

In the age groups it was: 5.0 and 6.4 in group I, 4.8 and 7.0 in group II, 4.5 and 8.4 in group III, 4.7 and 10.7 in group IV, 4.2 and 9.2 in group V, 4.7 and 10.7 in group VI.

SIZE OF THE CROSS-SECTION AREA OF FASCICLES

The thickness of the individual fascicle showed the following range of values: 0.004—3.750 sq mm in the lateral division, and 0.001—3.356 sq mm in the medial division. In the examined material very thin fascicles with the cross-section area up to 0.1 sq mm, thin fascicles (0.101—0.3 sq mm), medium-thick fascicles (0.301—0.5 sq mm), thick fascicles (0.501—1.0 sq mm) and very thick fascicles (over 1 sq mm) were differentiated. They appeared with different frequency in the lateral and medial divisions. Very thin fascicles (vtn) made 35.0% in the lateral division and 21.0% in the medial division, thin fascicles (tn) made 34.7% and 43.3% respectively, medium-thick fascicles (mtk) — 12.3% and 21.8%, thick fascicles (tk) — 8.5% and 11.5%, very thick fascicles (vtk) — 9.5% and 2.4%. The frequency of occurrence of differently thick fascicles in the described divisions of the lateral cord was unequal in the age groups. In group I vtn formed 62.9% in mc and 35.1% in rlm, tn 31.4% and 52.7%, mtk 3.2% and 9.8%, tk 2.5% and 2.4%, and vtk 0% and 0% respectively. In group II vtn composed 40.5% and 14.6%, tn 37.6% and 47.4%, mtk 12.1% and 26.9%, tk 2.3% and 10.3% vtk 7.5% and 0.8% respectively. In group III vtn reached 15.9% and 12.6%, tn 44.0% and 40.2%, mtk 15.9% and 26.2%, tk 12.1% and 16.8%, vtk 12.1% and 4.2% respectively. In group IV vtn created 27.3% and 23.5%, tn 31.4% and 43.8%, mtk 16.5% and 17.8%, tk 9.1% and 12.4%, vtk 15.7% and 2.5% respectively. In group V vtn constituted 19.0% and 19.2%, tn 38.9% and 35.5%, mtk 14.3% and 25.4%, tk 11.1% and 15.9%, vtk 16.7% and 4.0% respectively. In group VI vtn made 31.3% and 21.9%, tn 25.0% and 42.2%, mtk 15.2% and 23.4%, tk 19.6% and 9.8%, vtk 8.9% and 2.7% respectively.

The value of the cross-section area of all the fascicles forming mc ranged between 0.293 and 4.777 sq mm, and in rlm between 0.347 and 6.759 sq mm. It was similar on both sides of one body in 15.2% in mc and

in 5.8% in rlm, greater on the right side in 36.0% and 47.7%, greater on the left side in 48.8% and 47.7% of the cases respectively. The sum of the thicknesses of fascicles of mc compared with the respective sum of rlm was similar in 5.2%, greater in 15.7% and smaller in 79.1% of the cases.

The average value of the cross-section area of mc fascicles equalled (in sq mm) 1.650 (r — 1.602, l — 1.697, ♂ — 1.604, ♀ — 1.695) and of rlm 2.426 (r — 2.463, l — 2.389, ♂ — 2.396, ♀ — 2.456). It was different in the age groups. In group I the average value was: in mc 0.603 and in rlm 1.040, in group II respectively 1.256 and 1.853, in group III 2.101 and 3.080, in group IV 2.169 and 3.109, in group V 2.169 and 2.969, in group VI 1.972 and 3.061.

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

The magnitude of the index of the fascicle's area of mc ranged between 42.5 and 86.2, and of rlm ranged between 27.4 and 79.1. It was similar on both sides of one body in 10.5% in mc and in 7.0% in rlm, greater on the right side in 43.0% and 44.2%, greater on the left side in 46.5% and 48.8% of the cases respectively. IAF showed similar values in both terminal parts of the lateral cord in 6.6%, greater in mc in 68.0%, greater in rlm in 24.4% of the cases.

The average value of the index equalled in mc 65.8 (r — 65.5, l — 66.1, ♂ — 66.5, ♀ — 65.1) and in rlm 53.0 (r — 53.2, l — 52.7, ♂ — 53.7, ♀ — 52.2). The value mentioned above in the age groups ranged as follows: in group I in mc it was 62.3 and in rlm it was 61.4, in group II respectively 64.9 and 61.0, in group III — 69.5 and 51.6, in group IV — 66.4 and 48.5, in group V — 67.6 and 53.1, in group VI — 61.7 and 50.1.

DISCUSSION

The lateral cord usually divides into two terminal parts — lateral and medial. The lateral part becomes the musculocutaneous nerve, the medial part becomes the lateral root of the median nerve (3, 5, 8). The same status was observed in all the cases in the present work.

The internal structure of the examined parts of the lateral cord, in contradiction to their external structure, is characterized by great variability and asymmetry. These observations are confirmed by the reports of numerous authors, who examined peripheral nervous system (1, 2, 4, 6, 7, 9—14). The studies performed have shown that the thickness of both terminal parts of the lateral cord, number of fascicles, size of the cross-section area of fascicles and index of the fascicle's area were different in the majority of cases not only in people 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 one body. The same or similar values of 4 features on both sides of one body were found only in 1.2% in rlm, for 3 features — in 1.2% only in mc, and for 2 features — in 5.8% in mc and in 4.7% in rlm. Similar values of single features were also rarely observed on both sides of one body: the thickness of mc in 4.7% and that of rlm in 7.0%, the size of cross-section area of fascicles in 12.8% and 2.3%, the number of fascicles in 8.1% and 7.0%, and IAF in 7.0% and 3.5% of the cases respectively.

The examined features were greater in a single person on the right than on the left side: the thickness of mc in 43.0% and that of rlm in 50.0%, the size of cross-section area of fascicles in 36.0% and 47.7%, the number of fascicles in 47.7% and 45.3%, and IAF in 43.0% and 44.2% respectively. The above features in a single person had greater values on the left than on the right side: the thickness of mc in 47.7% and that of rlm in 40.7%, the size of cross-section area of fascicles in 48.8% and 46.5%, the number of fascicles in 39.5% and 44.2%, and IAF in 46.5% and 48.8% respectively.

The mean values of the examined features differed between the sides of a single body. They were greater in mc on the left than on the right side with the exception of the number of fascicles which was greater on the right than on the left side. In rlm they were greater on the right side with the exception of the number of fascicles which was greater on the left side. They showed the differences related to the sex, too. In females the thickness of both terminal parts of the lateral cord, the number of their fascicles and the size of cross-section area of fascicles were greater than in males, on the contrary in males IAF was greater than in females.

rlm compared with mc was thicker by 82.8% (r — 89.5%, l — 76.4%, ♂ — 85.0%, ♀ — 80.7%), it had the size of the cross-section area of fascicles greater by 47.0% (r — 53.7%, l — 40.8%, ♂ — 49.4%, ♀ — 44.9%), and it had the number of fascicles greater by 87.0% (r — 75.5%, l — 97.7%, ♂ — 92.9%, ♀ — 78.4%), on the contrary it had the index of the fascicles's area smaller by 19.5% (r — 18.8%, l — 20.3%, ♂ — 19.2%, ♀ — 19.8%).

The participation of fascicles of various thickness in the structure of both terminal parts of the lateral cord was unequal. vtn and vtk were observed more often in mc, but tn, mtk and tk were found more often in rlm. tk and vtk occurred more often on the left side in mc, and were present equally on both sides of one body in rlm. Certain differences in the fascicular structure were observed in relation to the sex: mtk occurred more often in females in mc, and in males in rlm, tk were present equally in the persons of both sexes in mc, and appeared more often in males in rlm, but vtk were found more often in females in mc, and were present equally in the persons of both sexes in rlm.

The examined features underwent big changes in postnatal life, especially in the age up to 22nd year. The thickness of mc increased 3.4 times, and of rlm 3.8 times. The size of the cross-section area of fascicles increased 3.6 and 3.0 times respectively. The index of the fascicle's area in mc increased by over 11%, but decreased by 20% in rlm. The number of fascicles in adults was almost by 20% smaller than in children up to 1 year of life in mc, but it was by over 67% greater in rlm. The participation of fascicles of different thickness in the structure of the discussed parts changed in postnatal life, too. In children up to 1 year the fascicles of the cross-section area up to 0.3 sq mm dominated in the structure of both parts. In adults their participation in the structure of mc and rlm decreased, while the share of fascicles with the cross-section area greater than 0.3 sq mm increased considerably.

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STRESZCZENIE

Pęczek boczny, badany obustronnie na 86 zwłokach ludzi, dzieli się na dwie końcowe części, z których boczna stanowi n. mięśniowo-skórny, a przyśrodkowa — korzeń boczny n. pośrodkowego. Korzeń ten w porównaniu z n. mięśniowo-skórnym jest grubszy o 82,8%, ma powierzchnię poprzecznego przekroju pęczków większą o 47% i liczbę pęczków większą o 87%, natomiast wskaźnik powierzchni pęczków mniejszy o 19,5%. W n. mięśniowo-skórnym występują częściej niż w korzeniu bocznym n. pośrodkowego pęczki bardzo cienkie i bardzo grube, a rzadziej pęczki cienkie, średniej grubości i grube.

