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Fascicular Structure of the Root of the Brachial Plexus from C₆ in Man

Budowa pęczkowa korzenia splotu ramiennego z C₆ u człowieka

The external structure of the brachial plexus root coming out of the anterior branch of the 6th cervical nerve, was described in details, but its internal structure was investigated only fragmentarily. This is the reason why I decided to work on some features of its internal texture, on a quite wide material.

MATERIAL AND METHODS

The root of the brachial plexus from C₆ has been examined bilaterally on the bodies of 35 males (♂) and 34 females (♀) who died at the age between 11th day and 86th year of life. Six age groups were distinguished, like in the previous paper dealing with the morphology of the peripheral nervous system (7). The group I included 5 ♂ and 5 ♀, group II — 6 ♂ and 5 ♀, group III — 5 ♂ and 8 ♀, group IV — 5 ♂ and 6 ♀, group V — 9 ♂ and 5 ♀, group VI — 5 ♂ and 5 ♀. The sections up to 12 mm long were taken from the initial part of the root, and then, after the fixation in a glass frame they were preserved in formalin. Then the cross-section slides 15 μm thick were prepared and stained with Klüver-Barrera's method. The thickness of the root, the number of fascicles and the size of their cross-section area were determined in each of the preparation. The value of the index of fascicular area was calculated in each of the cases, according to suggestions presented in the previous paper (7)

RESULTS

Thickness of the root

The size of the root's cross-section area derived from the sixth cervical nerve ranged from 2.345 to 17.345 sq mm. The value was the same on both sides of one body in 4.3%, greater on the right side in 46.4% and on the left side in 49.3% of the cases. The average size of the cross-section area of the brachial plexus root coming from C₆, is presented in Table 1. In the examined material it equalled

Table 1. Mean cross-section area of the root of the brachial plexus form C₆

Sex	Side	Age groups					
		I	II	III	IV	V	VI
♂	R	3.144	5.279	9.123	10.245	10.990	11.990
	L	2.600	5.362	9.052	9.986	11.531	11.293
	R+L	2.872	5.321	9.087	10.116	11.261	11.641
♀	R	3.400	5.652	9.886	10.421	11.573	9.571
	L	4.171	5.088	9.337	10.018	12.919	7.744
	R+L	3.785	5.370	9.612	10.220	12.246	8.657
♂+♀	R	3.272	5.449	9.593	10.341	11.198	10.780
	L	3.386	5.237	9.228	10.004	12.027	9.518
	R+L	3.329	5.343	9.410	10.172	11.612	10.149

Explanation: R -- right side, L -- left side, R + L -- right + left.

8.556 sq mm, where on the right side it was 8.633 sq mm, on the left side — 8.479 sq mm, in men — 8.624 sq mm, in women — 8.485 sq mm. It had the lowest value in the age group I, and the highest — in group V.

Number of fascicles

The examined segment of the root of the brachial plexus coming from C₆ was composed of 1—15 fascicles. The root contained only one fascicle in 20.3%, two fascicles in 13.8%, three in 19.6%, four in 11.6%, five in 10.1%, six in 5.1%, seven in 5.8%, eight in 2.9%, nine in 3.6%, ten in 2.9%, eleven in 3.6%, and fifteen in 0.7% of all the cases. The same number of fascicles on both sides of one body was found in 31.9%, the greater number on the right side appeared in 30.4%, and on the left side in 37.7% of the cases. The mean number of fascicles in discussed material equalled 4.1, where on the right side it was 3.9, on the left side — 4.3, in men — 4.0, and in women — 4.2. In respective age groups it come out as follows: in the Ist age group 3.0, in the IInd — 4.5, in the IIIrd — 5.1, in the IVth — 4.0, in the Vth — 3.8, and in the VIth — 3.9.

Size of the cross-section area of fascicles

The thickness of an individual fascicle of the root of the brachial plexus coming from C₆ ranged from 0.031 to 12.994 sq mm. Five groups of the fascicles were distinguished on the basis of their cross-section area. They were: very thin with cross-section area up to 0.100 sq mm, thin (from 0.101 to 0.300 sq mm), medium-thick (from 0.301 to 0.500 sq mm), thick (from 0.501 to 1.000 sq mm), and very thick (over 1.000 sq mm). Very thin fascicles made 4.1%, thin — 17.0%, medium-thick — 18.2%, thick — 16.5%, very thick — 44.2% of all the fascicles in the root. The frequency of occurrence of very thin, medium-thick and thick

fascicles was similar on both sides of the body, but thin fascicles appeared more often on the left side, and very thick fascicles — on the right side. Thin and very thick fascicles were found more frequently in males, and very thin, medium-thick and thick — more frequently in females. The greatest differences in the fascicular structure of the root of the brachial plexus coming from C_6 were present between the age groups. They depended mainly on decrease of participation of very thin and thick fascicles, and increase of participation of medium-thick and very thick fascicles in its structure in the groups assembling older persons in comparison with the groups concentrating younger persons.

The cross-section area of all the fascicles of examined root ranged from 1.767 to 12.994 sq mm. It showed similar values on both sides of one body in 1.4%, it was greater on the right side in 56.5%, and on the left side in 42.0 of all the cases. The average value of the cross-section area of the fascicles of examined root equalled 6.220 sq mm, 6.281 sq mm on the right and 6.159 sq mm on the left side, 6.271 sq mm in males and 6.168 sq mm in females. The discussed value in the age groups came out to be: in the Ist group 2.655 sq mm, in the IIInd — 3.802 sq mm, in the IIIrd — 6.747 sq mm, in the IVth — 7.426 sq mm, in the Vth — 8.470 sq mm, and in the VIth — 7.281 sq mm.

Index of the cross-section area of fascicles (IAF)

The average value of the index of the cross-section area of fascicles equalled 72.7. It showed similar values on both sides in males as well as in females. The values mentioned above ranged as follows: in the Ist age group 79.8, in the IIInd — 71.2, in the IIIrd — 71.7, in the IVth — 73.0, in the Vth — 72.9, and in the VIth — 71.7.

DISCUSSION

The structure of the brachial plexus root coming from the sixth cervical nerve is characterized by a great individual variability concerning its thickness, the number of fascicles, the size of their cross-section area and the value of the index of fascicular cross-section area. These observations confirmed the reports of numerous authors as well as our own dealing with internal structure of various nerves (1—10). The similar values of all the mentioned above features of the examined root were not found either in persons of the same height and body weight, belonging to one age group or even on both sides of one body. The similar values of a single characteristic of the root on both sides of one body were found rather seldom: the thickness of the root in 4.3%, the size of the cross-section area of fascicles — in 1.4% and the index of the cross-section area of fascicles — in 2.9% of cases; only the number of fascicles was equal on both sides of one body in

as many as 31.9% of all the cases. In the same person: the thickness of the root was greater on the right side in 46.4%, on the left side — in 49.3%, the number of fascicles was greater on the right side in 30.4%, on the left side — in 37.7%, the size of the cross-section area of fascicles was greater on the right side in 56.5%, on the left side — in 42.0%, and the index of the cross-section area of fascicles was greater on the right side in 50.7%, on the left side — in 46.4% of cases.

The mean values of the examined features of the root were different on both sides of each body with the exception of the IAF. The thickness of the root was greater on the right side than on the left by 1.8%, and the cross-section area of fascicles by 2.0%. On the contrary the mean value of the number of fascicles was greater on the left side than on the right side by 10.3%. They showed, with the exception of IAF, the differences related to the sex, too. In males the thickness of the root was greater by 1.6%, and the cross-section area of fascicles by 1.7% than in females, on the contrary in females the number of fascicles was greater by 5.0% than in males.

Unequal percentage participation of differently thick fascicles in the root was observed in relation to the side of the body and the sex. Thin fascicles occurred more often on the left than on the right side and very thick — more often on the right than on the left side. Thin and very thick fascicles were found more often in males than in females and very thin, medium thick and thick fascicles — more often in females than in males.

The examined features of the brachial plexus root coming from the sixth cervical nerve underwent changes during the postfetal life. The number of fascicles was the only feature which did not change. The thickness of the root increased 3.5 times and the size of the cross-section area of fascicles — 3.2 times, but the index of the cross-section area of fascicles decreased by about 12%. The participation of fascicles of different thickness changed in postfetal life, too: the occurrence of very thin and thick fascicles decreased and the participation of medium-thick and very thick fascicles increased. The above changes took place mostly up to 22nd year of life.

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STRESZCZENIE

Grubość korzenia splotu ramiennego z C_6 , wielkość powierzchni poprzecznego przekroju jego pęczków, liczbę pęczków i wskaźnik powierzchni pęczków badano obustronnie na zwłokach 69 osób. Przeciętne wartości charakteryzujące badane cechy korzenia po obu stronach ciała różniły się między sobą, z wyjątkiem wskaźnika powierzchni pęczków. Po prawej stronie były większe niż po lewej: grubość korzenia o 1,8% i wielkość powierzchni poprzecznego przekroju pęczków o 2,0%, natomiast po lewej stronie była większa niż po prawej liczba pęczków o 10,3%. Wykazywały one, z wyjątkiem wskaźnika powierzchni pęczków, również różnice związane z płcią. U osób płci męskiej były większe niż u osób płci żeńskiej: grubość korzenia o 1,6% i wielkość powierzchni poprzecznego przekroju jego pęczków o 1,7%, natomiast u osób płci żeńskiej była większa niż u osób płci męskiej liczba pęczków o 5,0%. W życiu pozapłodowym znacznie zwiększyła się grubość korzenia i wielkość powierzchni poprzecznego przekroju jego pęczków, nieco zmniejszyła się wskaźnik powierzchni pęczków, natomiast nie zmieniała się liczba pęczków.

