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Some Features of the Internal Structure of the Root of the Brachial Plexus from C_5 in Postfetal Life in Man

Niektóre cechy wewnętrznej budowy korzenia splotu ramiennego z C_5 w życiu pozapłodowym człowieka

The anterior branch of the fifth cervical nerve makes the highest and always appearing root of the brachial plexus. The course and the connections of this root were precisely described on relatively wide material, but those investigations did not concern its internal structure. The purpose of this work was to determine the thickness of the brachial plexus root coming from C_5, as well as the number of its fascicles, the size and the index of their cross-section area.

MATERIAL AND METHODS

The study was done on 138 roots taken from the cadavers of 69 subjects who died at the age between 11th day and 86th year of life. The material, divided into 6 age groups, is presented in Table 1.

The roots of the brachial plexus were visualized by the preparation method. The sections up to 12 mm long were taken from the initial part of examined 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 cross-section area of the root, the number of its fascicles and their thickness were determined in each of the preparation, by means of a microscope with a drawing equipment and polar planimeter. The index of the fascicle's area (IAF) was calculated in all the cases using the formula presented in the previous paper (7).

RESULTS

The root of the brachial plexus coming from C_5, was present in all the cases and in 73.9% it made the highest root.

Table 1. The age and sex of studied subjects

Age groups	Age (in years)	Male	Female	Total
I	till 1 year	5	5	10
II	1—14	6	5	11
III	15—22	5	8	13
IV	23—40	5	6	11
V	41—60	9	5	14
VI	over 60	5	5	10
	Total	35	34	69

Thickness of the root

The size of the root's cross-section area ranged from 0.826 to 12.843 sq mm. In the same person values were greater on the right side in 68.1% and on the left side in 31.9%. The average size of the cross-section area of the brachial plexus root coming from C_5, is presented in Table 2. In the examined material it figured out to be 5.670 sq mm, where on the right side it was 4.805 sq mm, on the left side — 4.534 sq mm, in men — 4.519 sq mm, in women 4.825 sq mm. It had the lowest value in the age group I, and the highest — in group III.

Table 2. Mean cross-section area of the root of the brachial plexus from C_5

Sex	Side	Age groups					
		I	II	III	IV	V	VI
♂	R	1,613	3,408	6,874	5,043	4,702	6,228
	L	1,636	3,051	6,037	6,180	4,435	5,463
	R+L	1,624	3,230	6,455	5,612	4,569	5,845
♀	R	2,813	3,322	7,458	5,296	5,430	4,152
	L	2,153	3,066	6,513	5,718	4,257	4,856
	R+L	2,483	3,194	6,985	5,507	4,843	4,504
♂+♀	R	2,213	3,369	7,233	5,181	4,962	5,190
	L	1,894	3,058	6,330	5,928	4,371	5,159
	R+L	2,054	3,213	6,782	5,554	4,667	5,175

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

Number of fascicles

The initial segment of the root coming from C_5 of the brachial plexus was composed of 1—12 fascicles. The root contained only one fascicle in 31.2%, two fascicles in 17.4%, three in 13.8%, four in 10.9%, five in 11.6%, six in 7.2%, seven in 5.8%, nine in 1.4% , and twelve in 0.7% of all the cases. The same number of fascicles on both sides of one body was found in 30.4%, the greater number on the right side appeared in 36.2%, and on the left side in 33.3%. The

mean number of fascicles in discussed material equalled 3.1, both on the right and on the left side, but in men it was 3.6, and in women 2.3. In each of previously mentioned age groups it came out as follows: in the Ist age group 3.0, in the IInd — 3.4, in the IIIrd — 3.4, in the IVth — 3.0, in the Vth — 3.0, and in the VIth — 3.0.

Size of the cross-section area of fascicles

The thickness of an individual fascicle of the root ranged from 0.002 to 10.910 sq mm. Five groups of fascicles were distinguished on the basis of their cross-section area. They were: very thin of which the cross-section area was 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 10.2%, thin — 20.1%, medium-thick — 13.9%, thick — 19.0%, and very thick — 36.8% of all the fascicles in the root. Very thin and medium-thick fascicles occurred more often in males than in females and on the right than on the left side, and thin and thick fascicles — more frequently in females and on the left side, but very thick fascicles were present equally in males and in females and more often on the left than on the right side. The greatest differences in the fascicular structure of the root of the brachial plexus from C_5 were present between age groups. In the Ist age group about 3/5 of all the root's fascicles were very thin and thin. In the following age groups the participation of these fascicles in the root structure decreased considerably, while the share of the medium-thick and very thick fascicles increased greatly.

The cross-section area of all the fascicles of the examined root ranged from 0.556 to 11.211 sq mm. It showed similar values on both sides of one body in 1.4%, it was greater on the right side in 65.2%, and on the left side in 33.3% of all the cases. The average value of the cross-section area of the fascicles equalled 3.540 sq mm, 3.659 sq mm on the right and 3.420 sq mm on the left side, 3.414 sq mm in males and 3.669 sq mm in females. The discussed value in the age groups came out to be: in the Ist group 1.526 sq mm, in the IInd — 2.504 sq mm, in the IIIrd — 5.094 sq mm, in the IVth — 4.269 sq mm, in the Vth — 3.530 sq mm, and in the VIth — 3.883 sq mm.

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

The index ranged from 43.8 to 87.8. Mean value of IAF in the whole material was 75.8, being 76.1 on the right side and 75.4 on the left side, 75.6 in males, 76.0 in females. The values mentioned above, in the age groups ranged as follows: in the Ist group 74.3, in the IInd — 77.9, in the IIIrd — 75.1, in the IVth — 76.9, in the Vth — 75.6, and in the VIth — 75.0.

DISCUSSION

Though the root of the brachial plexus derived from the fifth cervical nerve appears always, still its internal structure has not been studied yet. The internal structure of the root is characterized by a great individual variability and asymmetry, like other cranial and spinal nerves (1—10). The number of fascicles, the size of their cross-section area, thickness of the root, and the value of IAF differed not only between people of the same age group and of the similar height and body weight, but also in the same person as regards both sides of his body. The same number of fascicles on the right and on the left side was observed in 30.4%, the similar value of the cross-section area of fascicles — in 1.4%, and the similar value of IAF — in 5.8% of cases, but the thickness of the root was different on both sides of the body in all the persons.

The mean numbers characterizing the examined features of root, were greater on the right than on the left side: the thickness of the root by 6.0%, the size of cross-section area of fascicles by 7.0%, the number of fascicles by 3.2%, and index of the area of fascicles — only by 0.9%, and they were greater in males compared with females: the thickness of the root — by 6.8%, the size of cross-section area of fascicles — by 7.5, the number of fascicles — by 6.7%, and the index of the area of fascicles by 0.5%.

There were found differences in the structure of the examined root, concerning the percentage participation of the differently thick fascicles in the root, related to the side of the body and to the sex. Very thin and medium-thick fascicles occurred more often on the right than on the left side and in males than in females, but thin, thick and very thick fascicles were more frequently found on the left than on the right side and in females than in males.

Out of the discussed features of the root of the brachial plexus arising from C_5, the thickness of the root as well as the size of cross-section area of its fascicles underwent big changes in the course of postfetal life. They had the lowest values in children up to 1 year old, and the greatest in people between the 15th and 22nd year of life. In the period from birth up to the 22nd year of life they increased 3.3 times. The participation of fascicles of different thickness changed in postnatal life, too. The very thin and thin fascicles of the cross-section area up to 0.300 sq mm, constituted about 3/5 of all, in children up to 1 year old. In the age between the 1st and the 22nd year of life their participation in the root structure decreased, while the share of fascicles with the cross-section area greater than 0.300 sq mm increased considerably.

REFERENCES

1. Goldberg I.: The Internal Architecture of the Tibial, Peroneal and Obturator Nerves. Am. J. Anat. **32**, 447, 1923/1924.

2. Михайлов С. С.: Внутриствольное строение периферических нервов. А. Н. Максименков (Ред). Гос. Изд. Мед. Лит., Ленинград 1963.
3. Sunderland S., Bradley K. C.: The Cross-Sectional Area of Peripheral Nerve Trunks Devoted to Nerve Fibres. Brain **72**, 428, 1949.
4. Sunderland S., Cossar D. F.: The Structure of the Facial Nerve. Anat. Rec. **116**, 147, 1953.
5. Шаргородский Л. Я.: Об индивидуальных структурных особенностях периферических нервов. Вопр. Нейрохир. **10**, 29 1946.
6. Urbanowicz Z.: Fascicles of the Genitofemoral Nerve in Postfetal Life in Man. Folia Morphol. (Warszawa) **35**, 31, 1976.
7. Urbanowicz Z.: Niektóre cechy wewnętrznej budowy nerwów podobojczykowego i grzbietowego łopatki u człowieka. Ann. Univ. Mariae Curie-Skłodowska, Lublin, Sectio D **39**, 49, 1984.
8. Urbanowicz Z.: Załuska S.: Internal Structure of the Lateral Cutaneous Nerve of the Thigh in Postfetal Life in Man. Folia Morphol. (Warszawa) **36**, 293, 1977.
9. Załuska S.: Internal Structure of the Ilioinguinal Nerve in Postfetal Life in Man. Folia Morphol. (Warszawa) **35**, 41, 1976.
10. Załuska S. et al.: Internal Structure of the Medial Cutaneous Nerve of the Arm in Postfetal Life in Man. Folia Morphol. (Warszawa) **38**, 99, 1979.

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STRESZCZENIE

Strukturę korzenia splotu ramiennego z C_5, badaną obustronnie na 69 zwłokach ludzi zmarłych w wieku od 11 dnia do 86 lat, charakteryzowała duża osobnicza zmienność i asymetria. Przeciętne wartości badanych cech korzenia były większe po prawej stronie niż po lewej: grubość o 6,0%, wielkość powierzchni poprzecznego przekroju pęczków o 7,0%, liczba pęczków o 3,2%, a wskaźnik powierzchni pęczków tylko o 0,9%. Były one także większe u osób płci męskiej niż u osób płci żeńskiej: grubość korzenia o 6,8%, wielkość powierzchni poprzecznego przekroju jego pęczków o 7,7%, liczba pęczków o 6,7%, a wskaźnik powierzchni pęczków o 0,5%. W życiu pozapłodowym grubość korzenia i wielkość powierzchni poprzecznego przekroju jego pęczków powiększały się 3,3 razy, natomiast nie zmieniały się liczba pęczków i wskaźnik powierzchni pęczków.