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Fascicular Structure of the Root of the Brachial Plexus from C_8 in Postfetal Life in Man

Budowa pęczkowa korzenia splotu ramiennego z C_8 w życiu pozapłodowym człowieka

The anterior branch of the eighth cervical nerve makes one of the thickest roots of the brachial plexus. Literature describes the participation of this root in the structure of the inferior trunk of the brachial plexus and many of the nerves that reach the upper limb, but its internal structure has not been described. Due to this fact the author took an interest in some features of its internal structure during postfetal life.

MATERIAL AND METHODS

The study was carried out on 138 roots taken from the cadavers of 35 males (♂) and 34 females (♀) who died between the age of 11 days and 86 years. These were divided into six age groups, as described in the previous paper (8). 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 methods used to visualise the anterior branches of the cervical nerves, to obtain the samples and fix them, to stain the slides and determine the thickness of the root and its fascicles, the number of fascicles and the index of the fascicles' area, were described in the previous paper (8).

RESULTS

The root of the brachial plexus originating from the anterior branch of the eighth cervical nerve, was present in all the cases and usually was part of the inferior trunk.

Thickness of the root

The size of the cross-section area of the examined root ranged from 1.755 to 19.984 sq mm. The value was the same on both sides of the body in 4.3% of the

bodies, greater on the right side in 55.1% of the cadavers and on the left side—in 40.6% of the cases. The average sizes are shown in Table 1. The total average for the examined material was 9.230 sq mm. For the right side the average was 9.428 sq mm, for the left side—9.033 sq mm, for men—9.105 sq mm, for women—9.359 sq mm. The lowest value was obtained in age group I, and the highest in groups IV and V.

Table 1. Mean cross-section area of the root of the brachial plexus from C_8

Sex	Side	Age groups					
		I	II	III	IV	V	VI
♂	R	2.921	7.046	9.723	11.325	11.406	12.053
	L	3.148	6.399	10.343	9.617	11.493	10.990
	R+L	3.034	6.723	10.033	10.471	11.449	11.522
♀	R	4.085	6.694	12.106	12.612	11.443	8.371
	L	5.508	6.099	10.974	11.721	10.302	8.654
	R+L	4.796	6.396	11.540	12.166	10.872	8.513
♂+♀	R	3.503	6.886	11.189	12.027	11.419	10.212
	L	4.328	6.262	10.731	10.764	11.067	9.822
	R+L	3.915	6.574	10.960	11.396	11.243	10.017

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

Number of fascicles

The initial segment of the brachial plexus root from C_8 was formed by 1—14 fascicles. It contained only one fascicle in 35.5% of the cases, two fascicles—in 17.4%, three—in 14.5%, four—in 9.4%, five—in 8.0%, six—in 4.3%, seven—in 4.3%, eight—in 1.4%, nine—in 3.6%, ten—in 0.7%, and fourteen—in 0.7% of the cases. 31.9% of the bodies had the same number of fascicles on both sides, 23.2% presented a greater number on the right side, and 37.7%—on the left side. The mean number of fascicles in the examined material was 3.1, on the right side the mean was 2.7, on the left side it was 3.4, in men it was 3.2, and in women it was 3.0. For the different age groups the means were: in age group I—2.8, in group II— 3.2, in group III—3.3, in group IV—2.9, in group V—3.1, and in group VI—3.1, respectively.

Size of the cross-section area of fascicles

The thickness of an individual fascicle of the brachial plexus root originating from C_8 ranged from 0.001 to 15.871 sq mm. Five groups of fascicles were differentiated as described in the previous publication (9). Very thin fascicles comprised 2.8% of the total (2.1% on the right side, 3.3% on the left side, 3.1%

in men, and 2.5% in women). Thin fascicles made up 14.5% of the total (11.1% on the right side, 17.2% on the left side, 17.0% in men, and 11.8% in women). Medium-thick fascicles comprised 11.5% of the total (10.6% on the right side, 12.2% on the left side, 12.9% in men, 9.9% in women). Thick fascicles made up 18.5% of the total (18.0% on the right side, 18.9% on the left side, 20.5% in men, and 16.3% in women). Finally, very thick fascicles comprised 52.7% of the total (58.2% on the right side, 48.3% on the left side, 46.4% in men, and 59.6% in women). The frequency of occurrence of fascicles showing different thickness in the examined material was not the same in the respective age groups. The percentage of occurrence of fascicles turned out to be as follows: in age group I — very thin fascicles—5.4%, thin—26.8%, medium-thick—17.9%, thick—17.9%, very thick—32.1%. In age group II—4.2, 22.5, 15.5, 16.9 and 40.8%, respectively. In age group III—2.3, 10.3, 10.3, 25.3 and 51.7%, respectively. In age group IV—3.2, 6.3, 9.5, 11.1 and 69.8%, respectively. In age group V—1.1, 6.9, 8.0, 19.5 and 64.4%, respectively. Finally, in age group VI—1.6, 19.0, 9.5, 17.5 and 52.4%, respectively.

The cross-section area of all the fascicles of the brachial plexus root from C_8 ranged from 1.125 to 15.871 sq mm. In a single person values were greater on the right side in 62.3%, and on the left side in 37.7% of all the cases. The average value of the cross-section area of the fascicles of the examined root was 7.073 sq mm. 7.258 sq mm was the average value on the right side and 6.887 sq mm on the left side, it was 6.902 sq mm for males and 7.248 sq mm for females. These values in the different age groups were: in group I—3.277 sq mm, in group II—5.051 sq mm, in group III—8.108 sq mm, in group IV—9.052 sq mm, in group V—8.483 sq mm, and in group VI—7.595 sq mm.

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

The magnitude of the index of the fascicle's area ranged from 47.0 to 90.5. The value was the same on both sides of a single body in 14.5% of the cases, greater on the right side in 47.8%, and on the left side in 37.7% of the cases. The mean value of IAF in all the material was 76.6. The mean for the right side being 77.0 and 76.3 for the left side, 75.8 for males, 77.4 for females. These values in different age groups were the following: in group I—83.7, in group II—76.8, in group III—74.0, in group IV—79.4, in group V—75.4, and group VI—75.8.

DISCUSSION

The root of the brachial plexus from C_8 is always present and forms one of the thickest branches of this plexus. The internal structure of the examined root similarly to other nerves (1—11) is characterized by a great individual variability

and asymmetry, when considering both its thickness and the number of fascicles, the size of fascicles forming the root, and the value of the index of fascicular cross-section area. The identical or similar values for all the above mentioned features of the examined root were not found either in people belonging to the same age group and of the same height and similar body weight, or on both sides of the single body. Similar values even for a single characteristic of the root on both sides of a body were seldom found: the thickness of the root in 4.3% of the bodies, the number of fascicles in 31.9%, and the index of the fascicle's area in 10.1% of the cases. The size of the cross-section area of fascicles was different on both sides of the body in all the people.

Out of the examined features in a single person the following were greater on the right side than on the left side: the thickness of the root in 55.1% of the cases (by about half the size in 4.3%, from 1/4 to 1/2 in 13.1%, from 1/10 to 1/4 in 26.1%, and by less than 1/10 in 11.6% of the cases). The size of the cross-section area of fascicles was greater on the right side in 62.3% of the cases (by about half the size in 7.2%, from 1/4 to 1/2 in 11.6%, from 1/10 to 1/4 in 27.5%, and by less than 1/10 in 15.9% of the cases). The number of fascicles was greater on the right side in 23.2% of the cases (more than twice in 5.8%, from 1/2 to two times in 8.7%, and by less than half in 8.7% of the cases). Finally, the index of the cross-section area of fascicles was greater on the right side in 47.8% of all the cases (by about 1/5 in 5.8%, from 1/10 to 1/5 in 13.0%, and by less than 1/10 in 29.0% of the cases). The above features in a single person had greater values on the left side than on the right side: the thickness of the root in 40.6% of the cases (by about half the size in 5.8%, from 1/4 to 1/2 in 11.6%, from 1/10 to 1/4 in 19.9%, and by less than 1/10 in 7.2% of the cases). The size of the cross-section area of fascicles was greater on the left in 37.7% (by about half the size in 8.7%, from 1/4 to 1/2 in 8.7%, from 1/10 to 1/4 in 17.4%, and by less than 1/10 in 2.9% of the cases). The number of fascicles was greater on the left side in 44.9% of the cases (more than twice in 17.9%, from 1/2 to two times in 17.4%, and by less than half in 11.6% of the cases). Finally, the index of the cross-section area of fascicles was greater on the left side in 37.7% of all the cases (by about 1/5 in 2.9%, from 1/10 to 1/5 in 7.2%, and by less than 1/10 in 27.5% of the cases).

The mean values of the following examined features of the root were greater on the right side than on the left: the thickness, by 4.4% and the size of the cross-section area of fascicles — by 5.4%, on the left side the number of fascicles was greater by 25.9%, but the index of the cross-section area of fascicles had similar values on both sides of the body. They showed differences related to sex. In females the thickness of the root was greater than in males by 2.8%, the cross-section area of fascicles — by 5.0%, and the IAF — by 2.1%. None the less, in males the number of fascicles was greater by 6.7% than in females.

The participation of fascicles of different thickness in the structure of the brachial plexus root from C_8 showed differences related to the side of the body

and to sex. The fascicles of a cross-section area of up to 1 sq mm occurred more often on the left side than on the right side and were more frequent in males than in females, but very thick fascicles of a cross-section area greater than 1 sq mm, were found more frequently on the right side than on the left side and had a greater occurrence in females than in males.

The studied features of the root, apart from the number of fascicles, underwent big changes on postfetel life, especially between the age of 1 and 14 years. The following increased: the thickness of the root — 2.9 times, the size of the cross-section area of fascicles — 2.8 times, but the index of fascicles cross-section area decreased by 13.0%. The participation of fascicles of different thickneses in the structure of the root changed in postfetel life too. The very thin, thin and medium-thick fascicles of a cross-section area of up to 0.5 sq mm, constituted over half of the total in children up to 1 year of age. At the age between the 1st and 22nd year of life their participation in the root structure decreased, while the proportion of fascicles with a cross-section area greater than 0.5 sq mm increased considerably.

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STRESZCZENIE

Badania wykonano na 138 korzeniach pochodzących ze zwłok 35 osób płci męskiej i 34 osób płci żeńskiej. W preparatach barwionych metodą Klüvera-Barrery oznaczano grubość korzenia, liczbę pęczków i wielkość powierzchni ich poprzecznego przekroju oraz ustalano wielkość wskaźnika powierzchni pęczków. Przeciętna grubość korzenia wynosiła 9,230 mm^2 i była większa o 4,4% po prawej stronie niż po lewej oraz o 2,8% u osób płci żeńskiej niż męskiej. Przeciętna liczba pęczków, wynosząca 3,1, miała większe o 25,9% wartości po lewej niż po prawej stronie oraz większe o 6,7% u mężczyzn niż u kobiet. Średnia wielkość powierzchni poprzecznego przekroju pęczków korzenia, osiągająca 7,073 mm^2, była większa o 5,4% po prawej stronie niż po lewej oraz większa o 5,0% u kobiet niż u mężczyzn. Średnia wielkość wskaźnika powierzchni pęczków, dochodząca do 76,6, miała podobne wartości po obu stronach ciała, natomiast była większa o 2,1% u kobiet niż u mężczyzn. W życiu pozapłodowym badane cechy korzenia, poza liczbą pęczków, ulegały dużym zmianom. Grubość korzenia powiększała się 2,9 razy, a wielkość powierzchni poprzecznego przekroju jego pęczków — 2,8 razy, natomiast zmniejszał się o 13% wskaźnik powierzchni pęczków.