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*Cutaneous nerves of the brachial plexus in postnatal
life in man*

Nerwy skórne splotu ramiennego w życiu pozapłodowym człowieka

Publications dealing with the internal structure of the cutaneous nerves in man appear comparatively rarely in the literature. Studies on this problem are often fragmentary and usually based on a small series of cases (4-6). Hitherto there are not many works discussing the internal structure of all cutaneous nerves of the brachial plexus, examined on material derived from cadavers of the same persons. The aim of this study was to examine the thickness of the medial cutaneous nerve of the arm, the number of fascicles, the size and the index of their cross-section area.

MATERIAL AND METHODS

The medial cutaneous nerve of the forearm and the medial cutaneous nerve of the arm have been examined bilaterally on the bodies of 40 males (♂) and 32 females (♀) who died at the age between the 1st day and the 87th year of life. They were free of any nervous system diseases. Six age groups were distinguished. Group I contained 6 ♂ and 6 ♀ up to 1 year of life, group II – 10 ♂ and 5 ♀ between the 1st and 14th year of life, group III – 5 ♂ and 5 ♀ between the 15th and 22nd year of life, group IV – 9 ♂ and 5 ♀ between the 23rd and 40th year of life, group V – 5 ♂ and 5 ♀ between the 41st and 60th year of life, group VI – 5 ♂ and 6 ♀ above the

60th year of life. The medial cord and its branches were visualized by the preparation method. The segments of the length of 8-15 mm were taken from the initial parts of the examined nerves, and then, after the fixation in a glass frames, they were fixed in formalin. The sections 15 μ m thick, being cross-sections of the nerves were taken out of the segments. Staining of the slides and the methods of determining the nerves and their thickness as well as the number of fascicles and the index of fascicles were presented in the previous paper (7).

RESULTS

The medial cutaneous nerve of the forearm (nf) and the medial cutaneous nerve of the arm (na) were present in all the cases. Each of them arose separately from the medial cord and was represented by a single branch.

THICKNESS OF CUTANEOUS NERVES

The thickness of the nf ranged between 0.231 and 3.703 sq mm, and of the na between 0.077 and 1.867 sq mm. It was similar on both sides of a single body in 4.2% in nf and in 5.6% in na, it was greater on the right side respectively in 51.4 and 44.4%, and greater on the left side in 44.4 and 50.0%. The discussed value of nf was greater than of na in 96.5% and lesser in 3.5% of the cases. The average thickness of nf equalled (in sq mm) 1.599 [on the right side (r) 1.627, on the left side (l) 1.571, in males (σ) 1.604, in females (φ) 1.593], and of na 0.422 (r – 0.435, l – 0.409, σ 0.431, φ 0.410). The discussed values come out to be: 0.730 and 0.232 in group I, 1.228 and 0.495 in group II, 1.892 and 0.399 in group III, 2.028 and 0.558 in group IV, 1.917 and 0.588 in group V, 1.953 and 0.453 in group VI respectively.

NUMBER OF FASCICLES

The initial segment of the nf was composed of 1-14 fascicles, and of the na (pama) of 1-16 fascicles. There were up to 5 fascicles observed in 33.4% in nf and in 85.8% in na, 6-10 fascicles in 59.0 and 11.1% respectively, and more than 10 fascicles in 7.6 and 2.1%. The nf contained seven fascicles (16.0% of the cases) most often, and the na three fascicles (22.2% of the cases) The same number of fascicles on both sides of one body was observed in 13.9% in nf and in 4.2% in na. The number of fascicles was greater on the right side of the body in 50.0 and 51.4%, and it was greater on the left side in 36.1 and

43.0% of the cases respectively. The number of fascicles was the same in both nerves in 8.3%, the greater number in the nf in 82.0%, and in the na in 9.7% of the cases.

The mean number of fascicles equalled in nf 6.7 ($r = 6.9$, $l = 6.6$, $\sigma = 6.6$, $\varphi = 6.9$), and in na 3.4 ($r = 3.5$, $l = 3.4$, $\sigma = 3.4$, $\varphi = 3.5$). In the age groups it was: 6.7 and 3.5 in group I, 6.8 and 3.2 in group II, 6.5 and 3.0 in group III, 6.4 and 3.7 in group IV, 7.0 and 3.3 in group V, 7.2 and 3.7 in group VI.

SIZE OF THE CROSS-SECTION AREA OF FASCICLES

The thickness of the individual fascicle showed the following range of values: 0.001 – 2.160 sq mm in nf, and 0.001 – 0.556 sq mm in mcna. There were differentiated: very thin fascicles (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 sq mm) and very thick fascicles (over 1 sq mm). Very thin fascicles (vtn) formed 53.7% in nf and 80.4% in na, thin fascicles (tn) formed 40.3% and 17.6% respectively, medium-thick fascicles (mtk) 5.5 and 1.4%, thick fascicles (tk) 0.4 and 0.6%, very thick fascicles (vtk) 0.1% only in nf. The frequency of occurrence of differently thick fascicles was unequal in the age groups. In group I vtn formed 82.2% in nf and 97.6% in na, th 17.8 and 2.4% respectively. In group II vtn composed 66.2% in nf and 82.5% in na, tn 31.9 and 16.5% respectively, mtk – 1.9 and 1.0%. In group III vtn reached 39.2% in nf and 77.1% in na, tn – 53.1% and 22.9% respectively, mtk – 6.9% and tk 0.8% only in nf. In group IV vtn created 38.0% in nf and 72.4% in na, tn – 51.4 and 23.8% respectively, mtk – 9.4 and 2.9%, tk – 0.6 and 0.9%, vtk – 0.6% only in nf. In group V vtn constituted 48.6% in nf and 71.6% in na, tn – 40.7 and 20.9% respectively, mtk – 10.0 and 4.5%, tk – 0.7 and 3.0%. In group VI vtn were present in 43.4% in nf and in 80.2% in na, tn in 50.3 and 19.8% respectively, mtk in 5.7 and tk in 0.6% only in nf.

The value of the cross-section area of all the fascicles (csaf) forming nf ranged between 0.106 and 2.160 sq mm, and forming na ranged between 0.046 and 1.288 sq mm. It was similar on both sides of one body in 13.9% in nf and in 5.6% in na, greater on the right side in 45.8 and 45.8%, greater on the left side in 40.3 and 48.6% of the cases respectively. The sum of the thicknesses of fascicles of nf compared with respective sum of na was similar in 1.4%, greater in 97.2% and smaller in 1.4% of the cases.

The average value of csaf was (in sq mm) in nf 0.816 ($r = 0.822$, $l = 0.810$, $\sigma = 0.819$, $\varphi = 0.813$), and in na 0.229 ($r = 0.239$, $l = 0.219$, $\sigma = 0.232$, $\varphi = 0.226$). The discussed values in the age groups come out to be: in group I 0.353 and 0.114, in group II 0.661 and 0.187, in group III 0.958 and 0.218, in group IV 1.041 and 0.313, in group V 0.988 and 0.334, in group VI 0.961 and 0.220 respectively.

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

The size of the index of the fascicle's area of nf ranged between 29.9 and 82.3, and of na – between 26.4 and 78.0. It was similar on both sides of one body in 6.9% in nf and in 4.2% in na, greater on the right side in 41.7 and 44.4% respectively, greater on the left side in 51.4 and 54.4% of the cases. The size of IAF showed similar values in both nerves in 6.9%, greater in nf in 32.0%, and greater in na in 61.1% of the cases.

The average value of the index equalled in nf 51.0 ($r = 50.5$, $l = 51.6$, $\sigma = 51.1$, $\varphi = 51.0$) and in na 54.3 ($r = 54.9$, $l = 53.5$, $\sigma = 53.8$, $\varphi = 55.1$). The value mentioned above ranged as follows in the age groups: in group I it was 48.4 in nf and 49.1 in na, in group II – 51.3 and 56.1, in group V – 51.5 and 56.8, in group VI – 49.2 and 48.6 respectively.

DISCUSSION

The literature describes in detail (1,2) the variations of beginning of medial cutaneous nerves – of the forearm and of the arm. In the presented study these nerves are present in all the cases and they arise separately from the medial cord. Their internal structure, similar to other nerves (3 – 10), shows great individual variability and asymmetry.

Out of the discussed features the following were greater on the right than on the left side: the thickness of nf in 51.4% and of na in 44.4%, the size of csaf in 45.8 and 45.8%, the number of fascicles in 50.0 and 51.5%, the index of the fascicle's area in 41.7 and 44.4% respectively. The features in a single person which had greater values on the left than on the right side were: the thickness of nf in 44.4 and of na in 50.0%, the size of csaf in 40.3 and 48.6%, the number of fascicles in 36.1 and 43.0%, the index of the fascicle's area in 51.4 and 51.4% respectively. The mean values of examined features were greater on the right than on the left side: the thickness of nf by 3.6% and of na by 6.4%, the size of csaf by 1.5 and 9.1%, the fascicle number by 4.5 and 2.9% respectively, and IAF only in na by 2.6%. The mean value of IAF in nf was greater by 2.2% on the left than on the right side. The average numbers in na showed certain differences related to the sex. The greater in males compared with females were: the thickness of nerve by 5.1% and the size of csaf by 2.7%, on the contrary, in females greater than in males were: the number of fascicles by 2.9% and IAF by 2.4%. In nf the difference related to the sex concerned only average number of fascicles which was greater by 4.5% in females than in males.

The cutaneous nerves differed between each other in thickness, number of fascicles, size and index of their cross-section area.

The thickness of nf was greater than the thickness of na in 96.5% of the cases. In the whole material the average thickness of nf was greater 3.8 times than the average thickness of na, but in age group I – 3.1 times, in group II – 2.5 times, in group III – 4.7

times, in group IV – 3.6 times, in group V – 3.3 times, and in group VI – 4.3 times. In the postnatal life the thickness of nf increased 2.8 times and of na – 2.5 times.

The number of fascicles in the initial segments of nerves was the same in 8.3%, greater in na in 9.7%, and greater in nf in 82.0% of the cases. In the whole material the average number of fascicles of nf was greater 2 times than the average number of fascicles of na. The average number of fascicles was the highest in group VI in nf and in groups IV and VI in na, but the smallest average number of fascicles – in group IV in nf, and in group III in na.

The value of csaf was similar in both nerves in 1.4%. It was greater in na in 1.4%, and greater in nf in 97.2% of the cases. In the whole material the average value of csaf of nf was greater than the corresponding value of na 3.6 times. In the postnatal life the values of csaf of both nerves increased 2.9 times.

Different thickness fascicles participation in the structure of initial segments of nerves was unequal. Tn and mtk were observed more often in nf, and vtn – more often in na. Vtn occurred more often on the right side in nf, and on the left side in na, but tn more often on the right side in na, and were present equally on both sides of the body in nf. Little differences in the fascicular structure were observed in relation to the sex: tn occurred more often in males in nf, but were present equally in the persons of both sexes in na. The participation of fascicles of different thickness changed in postnatal life in both nerves. Vtn made in nf 82.2% and in na 97.6% of all fascicles in children up to 1 year of life. In adults their percentage was smaller almost by half in nf and by 1/5 in na, but percentage of tn was greater by over 2.5 times in nf, and by over 7,8 times in na. Mtk were also present – often in nf, rarely in na. Tk appear comparatively rarely in both nerves, vtk – sporadically and only in nf. The size of IAF was similar in both nerves in 6.9%, greater in nf in 32.0%, and greater in na in 61.1% of the cases. In the whole material the average value of IAF of na was greater than the corresponding value of nf by 6.5%. The average value of IAF was the greatest in age group II in nf, and in group V in na, but it was the smallest in group I and II, respectively.

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STRESZCZENIE

W nerwach skórnych przyśrodkowych przedramienia (nf) i ramienia (na), pobranych obustronnie ze zwłok 72 osób obojga płci, badano grubość, liczbę pęczków i wielkość powierzchni ich poprzecznego przekroju (csaf) oraz wskaźnik powierzchni pęczków (IAF). Średnie wartości tych cech różniły się znacznie w obu nerwach. Nerw skórny przyśrodkowy przedramienia był 3,8 razy grubszy niż na, miał 2 razy większą liczbę pęczków oraz 3,6 razy większą csaf, natomiast na miał IAF większy o 6,5% niż nf. Udział pęczków o różnej grubości był także niejednakowy w obu nerwach.