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DISTANCE BETWEEN THE STYLOMASTOID AND JUGULAR FORAMENS IN PEOPLE WITH DIFFERENT CRANIAL INDICES

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The purpose of the study was to determine the distance between the stylomastoid and jugular foramina on dry skulls of people with different cranial indices. The study was conducted on 159 dry skulls. On all skulls, the length and width of the skull were measured using a sliding ruler, and then all skulls were divided into the following groups: brachiocranes, dolichocranes and mesocranes. The obtained data were recorded and subjected to statistical processing. When statistically analyzing the distance between the stylomastoid foramen and the jugular foramen in skulls of different shapes in terms of width, it was found that in all skulls this indicator shows high differential reliability. The distance between the stylomastoid and jugular foramina does not have clear differences on the right and left, but differs significantly in skulls with different indices. Moreover, in dolichocranes this size is larger than in brachiocranes and mesocranes.

Key words: stylomastoid foramen, jugular foramen, dolichocrane, brachiocrane, mesocrane.

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ВІДСТАНЬ МІЖ ШИЛОСОСЦЕПОДІБНИМ І ЯРЕМНИМ ОТВОРАМИ У ЛЮДЕЙ З РІЗНИМИ ЧЕРЕПНИМИ ІНДЕКСАМИ

Метою дослідження було визначення відстані між шилососцеподібним та яремним отворами на сухих черепах людей з різними черепними індексами. Дослідження проводилося на 159 сухих черепах. На всіх черепах за допомогою ковзної лінійки проводили вимірювання довжини та ширини черепа, далі всі черепи були поділені на такі групи: брахікрани, доліхокрани та мезокрани. Отримані дані були запротокольовані та зазнали статистичної обробки. При статистичному аналізі відстані між шилососцеподібним і яремним отворами в черепах різної форми за показником ширини встановлено, що у всіх черепах цей показник показує високу різницеву достовірність. Відстані між шилососцеподібним та яремним отворами не мають чітких відмінностей праворуч та ліворуч, проте достовірно відрізняються у черепів з різними індексами. При цьому у доліхокранів цей розмір більший, ніж у брахікранів та мезокранів.

Ключові слова: шилососцеподібний отвір, яремний отвір, доліхокран, брахікран, мезокран.

In recent years, due to the development of microsurgery, interest in the topography of the openings and canals of the skull base has increased significantly. The jugular foramen is known to have important clinical significance because many important neurovascular structures pass through or around it [3, 7]. Of particular interest are works on the relationship of the jugular foramen with the facial nerve, facial canal and stylomastoid foramen due to the fact that, as the authors point out, with some surgical approaches, as well as pathological processes (for example, tumors, some inflammatory processes) there is a risk of damage to the in one direction or another [4, 6]. When analyzing the literature, we came across a few works devoted to the study of the distance between the stylomastoid and jugular foramina. This is of great importance when choosing the size of the needle and the volume of the injected substance when performing a blockade of the Nadbath of the facial nerve, which can contribute to the occurrence of "jugular foramen syndrome" [12]. In the literature, we also have not found any works devoted to the study of this issue in connection with the peculiarities of the shape of the skull.

The purpose of the study was to determine the distance between the stylomastoid and jugular foramina on dry skulls of people with different cranial indices.

Material and methods. In order to solve this problem, the research was carried out on 159 dry certified skulls taken from the storage of the bone museum of the Department of Human Anatomy and Medical Terminology of the Azerbaijan Medical University. Skulls with deformations and fractures were not considered. On all skulls, using a sliding ruler, we measured the length-diameter frontooccipitalis (distance from the glabella to the opistocranion) and the width of the skull – diameter biparietalis (distance between the eurions). Further, using the formula width/length x 100 [2], all skulls were divided into the following groups: brachiocranes (wide skulls – index above 80), dolichocranes (long skulls – index below 74.9) and mesocranes (medium skulls – index between 75- 79.9). The distribution of material by cranial index is presented in the diagram (Fig. 1).

The obtained data were recorded and subjected to statistical processing. When analyzing indicators for variation groups, the arithmetic mean (M), standard error (±m), minimum and maximum indicators of

the series, average structure – Me (median), quartiles (Q1, Q3), 95 % confidence interval (95 % CI) were determined with determination of the lower and upper boundaries.

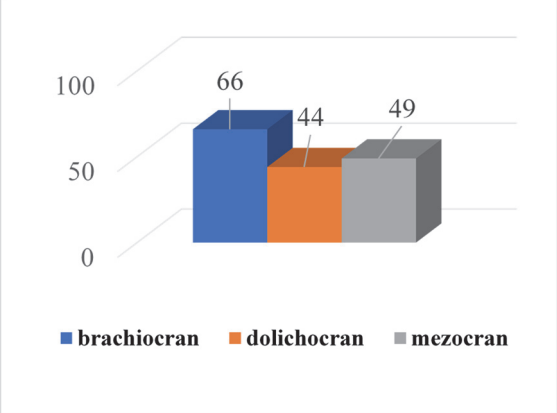

Fig. 1. Quantity distribution of the studied material according to the cranial index

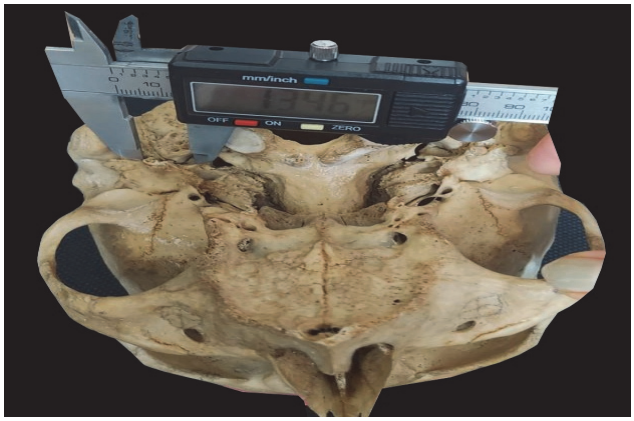

Fig. 2. Brachiocran, 64 years old. The distance between the stylomastoid and jugular foramina is 13.46 mm

The distance between the midpoints of the stylomastoid and jugular foramina on both sides was measured using an electronic caliper (Fig. 2). The differences between the indicators for all groups were assessed using the nonparametric H-Kruskal-Wallis (PH) method, and for comparison between two groups using the U-Mann-Whitney (PU) method. With statistical significance $p<0.050$, hypothesis "0" was rejected [1].

Results of the study and their discussion. When statistically analyzing the distance between the stylomastoid foramen and the jugular foramen in skulls of different shapes in terms of width (Fig. 3), it was found that in all skulls this number shows a high differential reliability (right and left $PH<0.001$).

This distance for brachiocranes on the right is 13.2±0.4 mm (min-max – 8.0-20.0; 95 % CI LB-UB – 12.5-14.0); left 13.7±0.4 mm (min-max – 8.0-21.0; 95 % CI LB-UB – 13.0-14.5); respectively, in dolichocranes – 15.5±0.4mm (min-max – 11.0-22.0; 95% CI LB-UB 14.6-16.3); 16.1±0.4mm (min-max – 10.0-20.0; 95 % CI LB-UB – 15.2-17.0) for mesocranes – 14.8±0.5mm (min-max – 10.0-24.0; 95 % CI LB-UB – 13.8-15.8); 14.6±0.4 mm (min-max – 10.0-22.0; 95 % CI LB-UB – 13.8-15.3). In the skulls of the latter type, the lower quartiles turned out to be very close to the median (right – Me = 14.0; Q1-Q3 = 13.0-17.0; left – Me = 14.0; Q1-Q3 = 13.0-16.0).

Comparison of brachiocranes with dolichocranes on both sides (right and left $PU<0.001$), comparison with mesocranes on the right ($PU=0.019$) and comparison of skulls of the latter type with dolichocranes on the left ($PU=0.006$) revealed a significant difference.

As is known, the jugular foramen, from where the internal jugular vein originates and the IX, X and XI pair of cranial nerves pass, also has a close relationship with the facial nerve and the origin of its trunk – the stylomastoid foramen [8]. Therefore, when performing surgical interventions in this area, as well as when blocking the facial nerve using the Nadbat method, iatrogenic problems may arise, contributing to the occurrence of "jugular syndrome" [11].

By examining the anatomy of the jugular foramen and its topography with the surrounding bony structures of the skull base, Sushant Swaroop Das et al. [5] measured the distance between the jugular and stylomastoid foramina. Researchers have shown that this distance is greatest on the left side. Similar data were also presented by Kotgirwar Sh., Athavale S.J. [9] who also pointed out gender differences in the length of this distance. However, the data obtained were not reliable. When studying differences in the Indian population, scientists did not consider the dependence of the data obtained on the shape of the skull in relation to the cranial index. We have established that there is a difference in the length of the distance between the stylomastoid and jugular foramina depending on the cranial index. Moreover, for long (dolichocranes) skulls this distance is greatest, and for wide ones it is smallest. Therefore, it can be assumed that the longitudinal increase in the skull lengthens the distance, and the transverse distance, on the contrary, shortens it. This can be explained by the fact that the measurement line is in a somewhat oblique direction; in dolichocranes it approaches the sagittal plane, and in brachiocranes, as well as in mesocranes, it approaches the frontal plane (Fig. 4).

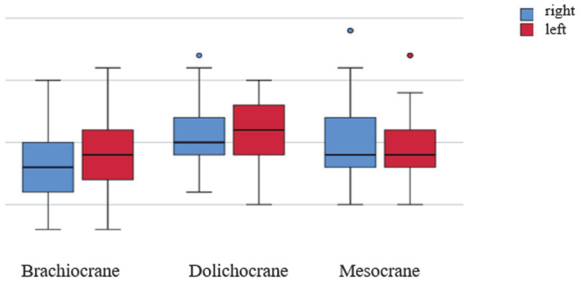

Fig. 3. Statistical analysis of the distance between stylomastoid and jugular foramina in the skulls with different width indices

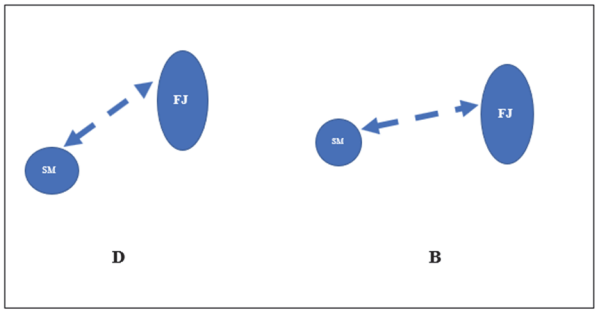

Fig. 4. Location of the stylomastoid (SM) and jugular foramina in dolichocranes (D) and brachiocranes (B)

The minimum and maximum dispersion we have established indicates the location of the holes, depending on the sample size and the dispersion of the indicators. The 95 % confidence interval, as well as the median and quartiles, make it possible to assess the significance of the parameters inherent in the same group of skulls depending on its shape according to the cranial index. In analyzing our data, we were greatly helped by the work of Nidhi Sharma, Rohit Varshney [13], who studied 100 skulls divided by sex (60 males and 40 females) and for the first time presented data on the distance between the stylomastoid and jugular foramina. While describing the value of this parameter in order to prevent complications during facial nerve blockade, the authors did not consider the dependence of this parameter on the shape of the skull. Neither gender characteristics nor significant differences were established when comparing indices on the right and left. We did not consider gender characteristics and also did not establish asymmetry between the sides of the measurement.

Conclusion

Thus, we have established that the distance between the stylomastoid and jugular foramina does not differ significantly on the right and left, but differs significantly in skulls with different width indices. Moreover, in dolichocranes this size is larger than in brachiocranes and mesocranes, which determines their location along the sagittal and frontal planes. These data are important for surgeons and anesthesiologists in order to exclude iatrogenic complications during facial nerve blockade according to Nadbat, when performing various surgical interventions in the middle part of the skull base, and can also be used as standards when comparing various pathologies.

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