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AGE-RELATED CHANGES IN THE SECOND KNEE AREA OF THE FACIAL CANAL

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ABSTRACT — The aim of the study was to measure the cross-sectional area near the second knee of the facial canal and to estimate the dependence of their values on age. Our data is of relevance for practical neuropathology, and may be one of the factors explaining the occurrence of paralysis and paresis of the facial nerve as a result of its compression in the facial canal (Bell's syndrome).

MATERIAL AND RESEARCH METHODS: The material for the study was tomograms of 28 patients (11 women, 17 men) of different ages, taken from the archives of the Department of Radiation Diagnostics and Radiation Therapy, Azerbaijan Medical University (Baku, Azerbaijan). The studies were carried out on a computer tomograph "Toshiba aquilion 128 ct scanner". Computed tomography made it possible to measure the bone canal in the axial and coronal planes. Images with insufficient image quality were not included in the study.

RESULTS: This study confirmed an anatomical difference in facial canal cross-sectional area in patients of different ages. The measurements showed that with age there is an increase in the cross-sectional area of the facial canal. However, in patients aged 46–69 years, there is a noticeable decrease in this indicator. This can be attributed to a decrease in the width of the mastoid segment of the facial canal in this age group.

KEYWORDS — cross-sectional area, second knee angle, facial canal.

INTRODUCTION

The facial nerve canal refers to the bony canal through which the facial nerve passes through the petrous part of the temporal bone from the internal auditory meatus to the stylomastoid foramen. There are three segments of the canal: labyrintic, tympanic, mastoid. The course of the facial nerve in a narrow bone canal is one of the main adverse developmental factors. The frequent vulnerability of the facial nerve in the same name canal is due to the fact that it occupies from 40 to 70% of its cross-sectional area [1]. A limited number of studies are available related to the study of the cross-sectional area of the facial canal. At the same time, no studies have been conducted on the relationship between the cross-sectional area of the facial canal in different age periods of postnatal development. In a number of works, the course and various morphometric parameters of the facial canal were carried out by the method of canal dissection at different levels [2]. Due to the tortuosity of the canal, such a method (sections in the frontal and sagittal planes) sometimes does not always reliably determine the topographic position of the study area. In recent years, methods of radiological research, in particular, computed tomography, have been widely used [3]. This method allows you to accurately determine the area of the study area and importantly to take measurements in a living person. In this work, we present morphometric data obtained from the analysis of tomograms. In particular, in these images, we studied the cross-sectional area of the facial canal at a certain level, near the knee of the facial canal, which is of practical importance for the surgery of this canal.

The aim of the study was to measure the cross-sectional area near the second knee of the facial canal and compare this indicator in patients of different ages.

MATERIALS AND METHODS

The material for the study was tomograms of 28 patients (11 women, 17 men) of different ages, taken from the archives of the Department of Radiation Diagnostics and Radiation Therapy, Azerbaijan Medical University (Baku, Azerbaijan). The studies were carried out on a computer tomograph "Toshiba aquilion 128 ct scanner". Computed tomography made it possible to measure the bone canal in the axial and coronal planes. Images with insufficient image quality were not included in the study. Using a computer method, the cross-sectional area of the facial canal was measured near its second knee. The patients were divided into age groups, so that 5 patients belonged to the age group of 7–16 years, 5 patients — 17–25 years, 5 patients — 26–35 years, 4 patients — 36–45 years, 9 patients — 46–69 years. For comparison, both bone canals (right and left sides) of each patient were measured.

RESEARCH RESULTS

This study demonstrated an anatomical difference in facial canal cross-sectional area depending on age. In patients belonging to the age group from 7 to 16 years, the minimum values of the cross-sectional

area of the facial canal at the level of the second knee were 0.97 mm² on the right, 1.00 mm² on the left, the maximum values were respectively 1.65 mm² on the right, 2.27 mm² left. In patients belonging to the age group of 17–25 years, the range of fluctuations of this indicator on the right was 0.93–2.74 mm², on the left 0.56–4.45 mm². The minimum and maximum values in patients of the age group of 26–35 years on the right were 1.82 mm² and 2.94 mm², on the left 1.04 mm² and 4.48 mm², in patients aged 36–45 years these figures were 1.86 mm² and 7 .05 mm² on the right, 1.12 mm² and 8.47 mm² on the left. In patients aged 46–69 years, the cross-sectional area has a minimum value of 1.05 mm² on the right and 1.04 mm² on the left, the maximum values were 3.82 mm² and 5.36 mm².

The measurement results are presented in the Table, which shows the values of the cross-sectional area of the facial canal. As can be seen from the table, with age, there is an increase in the cross-sectional area of the facial canal, however, in patients aged 46–69 years, there is a noticeable decrease in this indicator. This is due to a decrease in the width of the mastoid segment of the facial canal in this age group (Table 1).

When analyzing the tomograms, we also found that the shape of the second knee of the canal can be round, elliptical, or kidney-shaped. In this regard, the measurement of the cross-sectional area is more accurate than the measurement of the diameter. These data are consistent with the opinion of other authors (7), who thus determined a possible anatomical predisposition to Bell's palsy.

According to [8], a significant relationship was found between the degree of development of facial nerve palsy and the area of the facial canal at the level of the second knee.

Considering the parameters on the right and left, we found some asymmetry. So the parameters were somewhat larger on the right side, which corresponds to the generally accepted dominance of the right side than the left. Researchers studying possible factors leading to Bell's palsy [9, 10] have focused on measurements related to the tortuous course of the bony facial canal. Various anatomical variations in this canal can lead to compression of the facial nerve, culminating in Bell's syndrome [11,12].

Table 1. *Minimum and maximum values of the cross-sectional area near the knee of the facial canal in patients of different age groups*

Age	Number of cases	Cross-sectional area near the knee of the facial canal			
		Right		Left	
		Min	Max	Min	Max
7–16	5	0.97	1,65	1,00	2,27
17–25	5	0,93	2,74	0,56	4,45
26–35	5	1,82	2,94	1,24	4,48
36–45	4	1,86	7,05	1,12	8,47
46–69	9	1,05	3,82	1,04	5,36
Total: 7–69	28	M±m			
		2,05± 0,24		2,19± 0,32	

DISCUSSSION

According to Saito et al., [4], the ratio of the cross-sectional area of the facial nerve to the area of the facial canal in children was 0.31±0.08, 0.35±0.10, and 0.18±0.12, respectively, in the labyrinth, tympanic and mastoid segments, and in adults these figures were 0.4±0.07, 0.52±0.17 and 0.37±0.04, respectively. As a result, the authors concluded that children are less likely to have a pinched facial nerve in the facial canal. However, our studies show that this parameter in the area of the facial knee increases up to 36–45 years, and then sharply decreases towards the old age. This can be explained with a decrease in the mastoid segment closer to its outlet (stylomastoid foramen) with age, which are indicated in the works of other authors [5, 6].

CONCLUSION

Analysis of tomograms of the facial canal, in particular the second knee, showed that it has various shapes (round, elliptical and kidney-shaped). In this regard, the study of its cross section is more informative. We found that when considering the dynamics of age-related changes, this indicator tends to increase at 36–45 years. In people older than 46 years, this figure slightly decreased. Keeping the same trend, a certain predominance of these indicators was found on the right side, than to the left. The obtained results are of practical importance for practical neuropathology, and may be one of the factors explaining the occurrence of paralysis and paresis of the facial nerve as a result of its compression in the facial canal (Bell's syndrome).

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