LINEAR FEATURES OF PLANUM SPHENOIDALE IN ADULTS AND THEIR COMMON VARIABILITY

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ABSTRACT — The aim of this study is to identify the linear variability of the planum sphenoidale in adults, depending on the skull base type. Stereometry was used on 87 certified skulls to identify the basilar angle as well as to determine the base type; craniometry was employed to examine the linear planum sphenoidale parameters. The study outcomes revealed that a short and wide planum was typical for the plate-basilar craniotype; long and narrow planum pointed at the flexibasilar type; in case the planum was long and narrow at the anterior margin, and wide at the posterior area, it was attributed to mediobasilar type.

KEYWORDS — planum sphenoidale, sphenoid bone, craniotype, skull.

INTRODUCTION

The study of the morphology of the structure of the craniofacial complex is relevant for improving and developing new methods of diagnostics and surgical interventions on the maxillofacial region [1-5].

Currently, neurosurgery pays great attention to clinical anatomy issues focusing on developing proper surgical access to the brain lower surface and neurovascular formations, based on the variability of skull structures. One of such skull structures is the planum sphenoidale, which is part of the sphenoid upper wall, and which is involved in the development of the middle section of the anterior cranial fossa, located between the ethmoid bone cribriform plate and the sphenoid crest of the sphenoid bone [6, 7].

No clear boundaries have been developed so far, just like no algorithm has been designed for selecting surgical tactics in terms of getting access to neoplasms localized at the planum sphenoidale of the anterior cranial fossa [8, 9], which is due to lack of detailed metric information concerning the morphostereotopic variability of the planum sphenoidale in people of different age, sex and the skull shape [10, 11]. Respective literature offers scattered descriptions of the morphometric variability of the skull base bones and their structures [12–21], yet there is no systematic data available on the general variability of the planum sphenoidale linear features, which serves rationale for this study.

Aim of study

To identify the variability of the planum sphenoidale linear features in adults, depending on the skull base type

MATERIAL AND METHODS

The study involved 87 certified skulls people of mature age (21–60 years old) obtained from the collection of the fundamental museum at the Department for Human Anatomy, Saratov State Medical University. Stereotopometry was used to identify the basilar angle between the craniometric points (n-s-ba) for each skull, with 3 types of the skull base distinguished: flexi-, plate- and mediobasilar. The craniometry method was employed to examine the width of the planum sphenoidale anterior border – at the level of the ethmoid bone cribriform plate posterior edge; the posterior border – in between the midpoints of the visual channels anterior walls; the planum length on both sides of the skull.

The statistical processing of the obtained data was carried out with the Statistica 10.0 software in the Windows. For all the examined parameters, variation & statistics elements were identified – M, m, σ, Cv%, P. The statistically meaningful difference between the average values was calculated through the Student criterion. The differences were considered statistically meaningful at P <0.05.

RESULTS AND DISCUSSION

For the flexibasilar craniotype, the transverse size of the planum sphenoidale anterior border (10.8±0.2 mm) is 7.8 mm below that of the posterior

edge (18.6±0.3 mm; P <0.01). The planum longitudinal diameter on both sides of the skull has the same average value (15.6±0.4 mm; P> 0.05).

In case of the mediobasilar craniotype, the transverse size of the planum sphenoidale anterior edge (11.0±0.2 mm) is 8.6 mm smaller than that of the posterior border (19.6±0.3 mm; P <0.01). The average value of the planum longitudinal size on both sides of the skull revealed no statistical difference — 14.8–15.0±0.4 mm (P> 0.05).

For the plate-basilar craniotype, the planum sphenoidale anterior edge transverse size (12.0±0.4 mm) is by 7.8 mm exceeded by the posterior edge (19.8±0.4 mm; P <0.01). The longitudinal diameter of the planum sphenoidale on both sides of the skull showed no significant difference (13.8–13.9±0.4 mm; P> 0.05).

A comparative analysis of the planum linear parameters among the craniotypes showed that the transverse diameter of the planum sphenoidale anterior edge for the plate-basilar craniotype (12.0±0.4 mm) exceeded by 1.0 mm the medio- (11.0±0.2 mm; P<0.05) and by 1.2 mm – the flexibasilar (10.8±0.2 mm; P <0.05) types. The planum posterior edge transverse size for the plate- and mediobasilar craniotypes (19.8±0.4 mm and 19.6±0.3 mm, respectively) turned to exceed by 1.2 mm and 1.0 mm, respectively, if compared with the flexibasilar type (P<0.05).

The planum longitudinal size on both sides of the skull in the flexi- (15.6±0.4 mm) and mediobasilar (15.0±0.3 mm; 14.8±0.4 mm) craniotypes showed a statistically significant prevalence (by 1.8–1.9 mm; 1.2–1.1 mm) compared with the similar parameters for the plate-basilar type (13.8±0.3 mm; 13.7±0.4 mm; P <0.05, respectively).

The literature offers conflicting data on the effect that the type of the skull base has on the dimension-related features of the planum sphenoidale. Our study revealed the general variability of the planum sphenoidale linear features — in the plate-basilar skull type, the planum anterior and posterior edges are 1.1 times as wide compared to the medio- and flexibasilar types, while the planum is 1.1 times as long in case of the medio- and flexibasilar types compared to plate-basilar one. The planum posterior edge is wider than its anterior edge in each craniotype, whereas the average values of these parameters are dominant in the plate-basilar craniotype. However, there is no reliable way to compare the planum parameters variability, since the available literature contains no works focusing on the dimensional specifics of the planum sphenoidale and its variability that would allow detecting clear clinical diagnostic criteria for identifying the boundaries of

the radical removal of tumors found in the anterior and mid-cranial fossae [8, 9, 22, 23]. The respective literature offers only isolated data concerning lack of influence that the basilar angle has on the planum parameters variability; however, the authors hereto believe that the planum dimensional features should be taken into account when employing the transbasal approach to the resection area of the anterior cranial fossa middle section [24].

CONCLUSIONS

A short and wide planum sphenoidale is typical for the plate-basilar craniotype; long and narrow — for the flexibasilar type, while a planum that is long and narrow at the anterior edge, and wide at the posterior one typically belongs to the mediobasilar type. The obtained data can be used for morphological methods of clinical research, as well as it may be taken into account when planning surgical access to the neurovascular structures and the brain structures adjacent to the skull base bones.

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