

## Topographoanatomical Relation of the Trellised Labyrinth Structures Determining the Structure of Fronto-Nasal Duct

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**Abstract:** The conducted morphological study allowed us to determine the structural variants of the frontal sinus-ingrown cells of the anterior trellised labyrinth. We have defined their role in fronto-nasal duct narrowing.

**Key words:** Cells of a trellised labyrinth, sinus frontales, fronto-nasal duct, agger nasi, parisiana nomina anatomica

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### INTRODUCTION

Variability of topographoanatomical relations of the structures forming the anterior part of a trellised labyrinth and defining the structure of the fronto-nasal duct plays an important role in the development of inflammation process in the cells of both a trellised labyrinth and a frontal sinus (Draf *et al.*, 2000; Friedman *et al.*, 2000; Stammberger *et al.*, 1995; Wani *et al.*, 2009).

Widespread practical application of the endoscopic surgery methods allowed substantially improving treatment results and reducing the rehabilitation period of patients with chronic sinusitis. However, in some cases, we can see ineffectiveness of endoscopic approach, even with all the principles of this type of surgery observed (Friedman *et al.*, 2000; Tilley, 1914).

One of reasons for stickiness of the ethmoidal infundibulum due to its blocking from the frontal sinus is an ingrowing bulla frontalis of the trellised labyrinth, first described in 1892 by E. Zuckerk and I (Shoja *et al.*, 2008). Rhinosurgery manual guides have information only on the availability of frontoorbital cells that can affect the configuration of the lower regions of the frontal sinus and ethmoidal infundibulum (Stammberger *et al.*, 1995; Zinreich, 2005; Wani *et al.*, 2009; Kothari, 1972).

Having regard to the above, we may conclude about the need for cranoscopic study of this issue imposed by the requirements of rhinosurgery.

### MATERIALS AND METHODS

We assessed cranoscopic signs of the frontal structures of a trellised labyrinth on 120 macerated categorized male adult skulls (I-II adulthood periods), sawn in median sagittal and frontal planes and on 180 CT

scans which clearly identified bone structures of the anterior trellised labyrinth. We obtained tomograms of patients with chronic purulent and polypous rhinosinusitis, among them 46.5% women and 53.5% men with an average age of the total sample 41.2±2.2 years.

### RESULTS AND DISCUSSION

The results of cranoscopic study of 25 skulls (20.8%) allowed us to establish the alternatively varying characteristics of the structure of the anterior trellised labyrinth cells (front cell), growing into the frontal sinus and narrowing the upper section of the ethmoidal infundibulum.

The first anatomical variant is represented by a single cell of a trellised labyrinth, located above the agger nasi cell. This variant was found in 32% (8 skulls) of the total number of skulls with the frontal cells identified (Fig. 1a).

Most variable sign is represented by a few cells of a trellised labyrinth which are located above the agger nasi cells and spread in the frontal sinus. The second variant was established in 10 skulls (40% of the total number of skulls with the frontal cells identified) (Fig. 1b).

The third anatomical variant is represented by a large single pneumatized cell of the trellised labyrinth, growing into the frontal sinus. This alternatively varying sign is described in the anatomical and rhinologic manuals as a bulla frontalis. Cranoscopic study revealed this anatomical variant in 20% (5 skulls) (Fig. 2a).

Two skulls which makes 8% of all bulba frontalis revealed, had a specific variant named as "Asinus-in-sinus" when there is an isolated bulla on its inferior wall of the frontal sinus (Fig. 2b).

According to the computer-tomographic study, 32 (17.8%) of 180 patients with chronic rhinosinusitis had

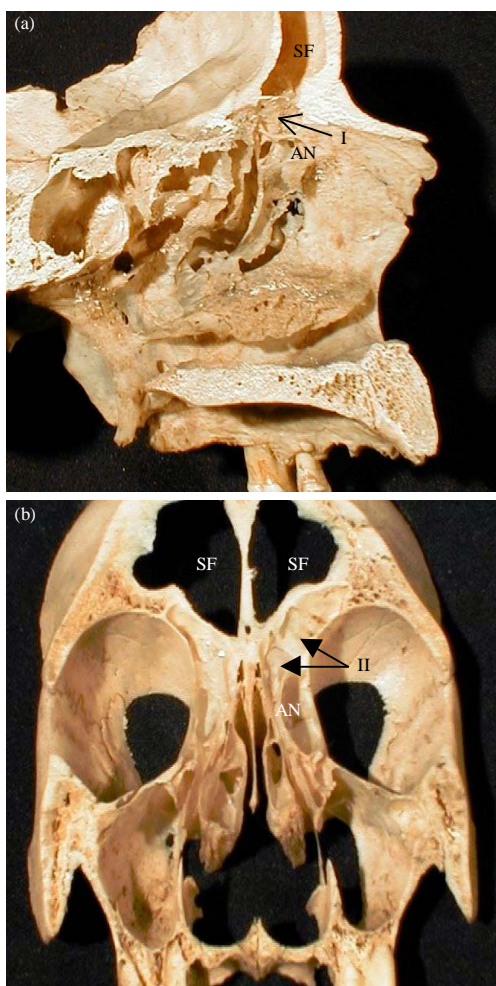


Fig. 1: Structural variants of frontal cells located in the anterior trellised labyrinth: a) (middle sagittal plane) one cell of the trellised labyrinth is above the agger nasi cell; b) (frontal plane) group of trellised labyrinth cells spreading in the frontal sinus. Scull cut: Nomenclature (AN): an agger nasi cell, SF: a frontal sinus; an arrow shows the alternatively varying location of a trellised labyrinth cell

48 alternatively varying diagnostic structural signs of cells of the anterior trellised labyrinth, growing into the frontal sinus-frontal cells which may disrupt aerodynamics and mucociliary clearance in the ethmoidal infundibulum, thereby being a predisposing factor of the development of chronic inflammation in the frontal sinus.

The first anatomical variant is represented by a single cell of a trellised labyrinth, located above the agger nasi cell. This variant was established in 10 patients, making 31.2% of the total number of patients with the frontal cells identified (Fig. 3a).

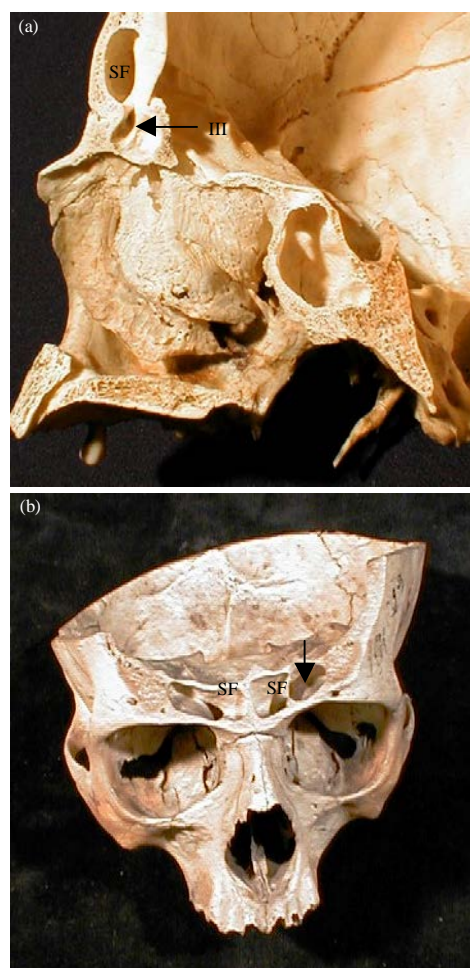


Fig. 2: Structural variants of frontal cells located in the anterior trellised labyrinth: a) (middle sagittal plane) pneumatized bulla frontalis of a trellised labyrinth; b) (frontal plane) isolated hyperpneumatized bulla frontalis Asinus-in-sinus. Scull cut: Nomenclature (SF): a frontal sinus; an arrow shows the alternatively varying location of a trellised labyrinth cell

The second variant is the most common to occur as well as in case of cranioscopic study. It is represented by a few bullae of a trellised labyrinth which are located above the agger nasi cells and spread in the frontal sinus. The second variant was established in 12 patients (20 observations with regard to contralateral nasal cavity), making 37.5% of the total number of patients with the frontal cells identified (Fig. 3b).

The third anatomical variant is represented by a large pneumatized bulla of the trellised labyrinth, growing into the frontal sinus. This is just the variant being described in rhinologic manuals as a bulla frontalis a large

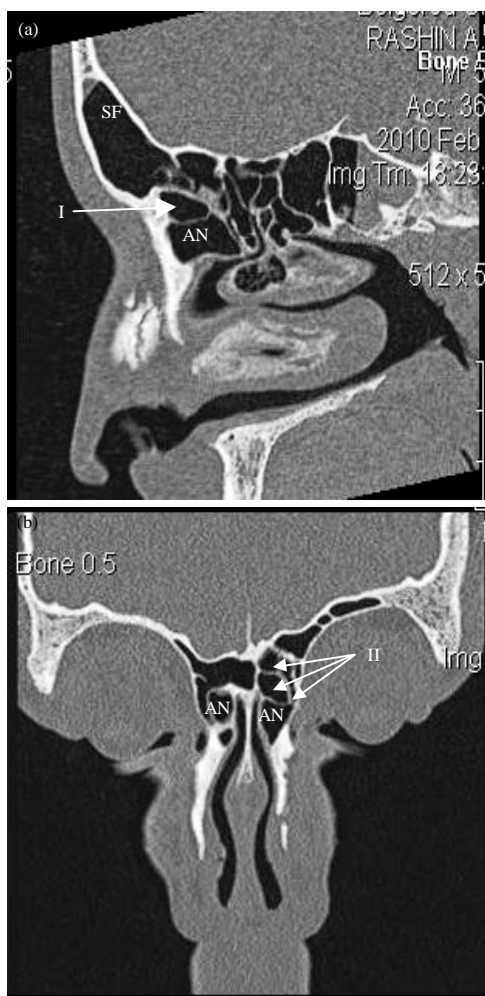


Fig. 3: Structural variants of bulla frontalis growing into the frontal sinus: a) (sagittal plane) a trellised labyrinth bulla is located above the agger nasi cell and blocks a fronto-nasal duct; b) (coronal plane) the group of trellised labyrinth bullae blocks a fronto-nasal duct from the left side. Computed tomography of the paranasal sinuses. Nomenclature (AN): an agger nasi cell, SF: a frontal sinus; an arrow shows the alternatively varying location of a trellised labyrinth cell

pneumatized cell of the trellised labyrinth that grows into the frontal sinus (Fig. 4a). This type of bulla was diagnosed in 7 patients (9 observations with regard to contralateral nasal cavity), making 21.8% of the total number of patients with the frontal cells identified.

We have diagnosed an isolated hyperpneumatized bulla in the frontal sinus in 3 patients (9.3%), identified on the anterior wall in 1 patient and on the inferior sinus wall in 2 patients (Fig. 4b).

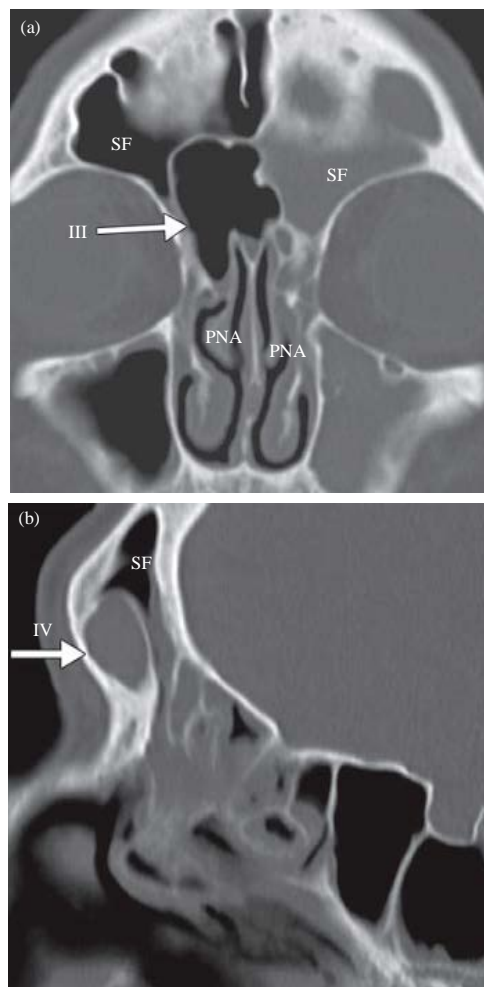


Fig. 4: Structural variants of bulla frontalis growing into the frontal sinus: a) (coronal plane) pneumatized bulla frontalis of a trellised labyrinth, growing into the frontal sinus and blocking the fronto-nasal duct from the right side; b) (axial plane) a large isolated bulla in the frontal sinus on the left side. Diagnostic variant of a mucocele. Computed tomography of the paranasal sinuses. Nomenclature (PNA): Parisiana Nomina Anatomica, SF: a frontal sinus an arrow shows the variant of bulla frontalis

## CONCLUSION

The identified features are of great practical importance and must be considered in modern morphological methods of clinical research such as computed tomography as well as surgical interventions in patients with chronic frontal sinusitis. Thus, in case of diagnosing either first or second structural variants of

bullae frontalis growing into the frontal sinus, the operation must be performed under video-endoscopic control.

In cases of diagnosing either third or fourth structural variants of bullae frontalis growing into the frontal sinus, the endoscopic method must be applied in combination with traditional trepanation of the frontal sinus.

Thus, we may conclude that there are multiple structural variants of the frontal sinus-ingrown cells of the anterior trellised labyrinth. The lack of ideas about alternatively varying signs of a trellised labyrinth structures may result in an incorrect choice of surgical treatment which in turn will affect the quality of the operation and a patient's recovery.

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