

# Computed Tomography Aspects of the Endoscopic Sinus Surgery in Children

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## **Abstract - Computed tomography aspects of the endoscopic sinus surgery in children**

### I. INTRODUCTION

Performances of endoscopic method in exploring the nasal and sinus cavity reduce the need for radiological examination in diagnosis of nasal obstruction. On the other hand, imaging plays an important role in assessing the etiology of sinusitis. If a tumor, a septal deviation, a cornet hypertrophy or choanal atresia, i.e., surface examination, can be detected by endoscopic investigation, expanding of the pathologic process can be appreciated only after performing imaging examination. Functional endoscopic surgical techniques proposed by W. Messerklinger are based on a correct diagnosis, which in its turn results from the information of endoscopic diagnostics and sinus computed tomography examination. With the development of endonasal surgery, visualization of the sinus cavities becomes essential for performing intrasinus surgery. Computed tomography examination is considered as the most informative imaging method for diagnosis of recurrent and chronic paranasal sinusitis. Under our supervision there were 120 children with recurrent and chronic sinusitis who underwent endoscopic endonasal surgery. The mentioned method of examination was used for the objectification of postoperative results.

### II. TOPICALITY

Recurrent and chronic paranasal sinusitis in children are quite common pathologic entities in everyday practice. Paranasal sinus inflammatory diseases in general and recurrent and chronic rhinosinusitis in children in particular are a difficult issue and in childhood and are registered with a frequency of 18-30% to 38-42% [1, 2, 3].

The issue of pathogenesis, early diagnosis and endoscopic surgical treatment is being studied in many centers by rhinologists, but so far remain unclear aspects of it. There are studies that reveal information about the importance of anatomic and physiological peculiarities of nasal cavities and paranasal sinuses in the pathogenesis of rhinosinusitis disorders [1, 3, 4]. In modern literature the pathogenesis of chronic and recurrent sinusitis is referred to as “cooperation” between infection and predisposing factors. Diagnosis and treatment of sinusitis in children has changed substantially over the past 10 years due to the wide spread and implementation of functional diagnostic methods (acoustic rhinometry, rhinomanometry), diagnostic imaging by computed tomography and rhinosinusitis endoscopy [4, 5, 6, 7]. One of the major symptoms presented by patients with recurrent and chronic sinus pathology is nasal obstruction which is a subjective parameter. The etiology and treatment of obstruction often relies on clinical and rhinoscopy data and rarely - on objective methods. Functional endoscopic surgery techniques proposed by Messerklinger are based on

a correct diagnosis, which in its turn results from diagnostic endoscopic examination and rhinosinusitis computed tomography [4]. A computed tomographic examination in coronary and axial sections allows studying the anatomical anomalies and variations of the lateral wall of nasal fossa and the objectification of the recurrent or chronic sinusitis. In a study by scientist R. Lusk and others, 115 children with symptoms of chronic and recurrent sinusitis were examined by computed tomography [7, 10]. Therefore, bone abnormalities were found in a large proportion of investigated patients: concha bullosa - 10% infraorbital cells - 10%, nasal septum deviation - 27.8%, paradoxical middle turbinate - 8.5%, uncinata process lateral deviation and hypoplasia of the maxillary sinus - 6.9%, enlarged nasal inferior turbinates - 6% [7, 10]. Preoperative CT provides a real map of the paranasal sinuses, providing a good study of normal anatomy of the face air cavities, which allows a precise description of dangerous relations, offering the possibility of a more beneficial, precise and limited therapeutic procedure.

**The goal of the research** was to evaluate the efficacy of the modern investigation method such as computed tomography in assessing anatomical architectonics of the nose and paranasal sinuses for determining the tactics of endoscopic surgical treatment in children with recurrent and chronic pathology of paranasal sinuses.

### III. MATERIALS AND METHODS

The study included 120 children with recurrent and chronic sinusitis, aged 8-17 years, divided into three lots of 40 ( $X^2=0$ ,  $p>0.05$ ). The overall average age of patients in the study groups was 13.9 years. The gender distribution analysis showed that 59 (49.2%) of patients were male, and 61 (50.8%) females. Thus, a statistically significant difference given by the parameter  $X^2 = 1.73$ ,  $P > 0.05$  was not noted.

Depending on the surgical treatment all the patients included in the study were divided into three groups. Group I consisted of 40 patients (21 boys and 19 girls) with recurrent and chronic paranasal sinusitis, operated by the standard method of endoscopic surgery (Messerklinger-Stammlinger technique). Group II consisted of 40 patients (18 boys and 22 girls), also with recurrent and chronic inflammatory disease of the paranasal sinuses treated by the method of minimally invasive endoscopic sinus surgery. Group III consisted of 40 patients (20 boys and 20 girls), homogeneous by nosologic structure, patients were operated on by minimally invasive technique completed with surgery on endonasal structures.

CT examination is essential in identifying sinus disorder difficult to diagnose in rhinoscopic, endoscopic or classic radiological examination. Computed tomography is of

particular value in diagnosing disorders of ostiomeatal complex and ethmoid, sphenoid sinus, impossible to determine using a traditional X-ray examination. Imaging study was performed in two planes - axial and coronal - using a Siemens Somatom Emotion Duo CT. The fineness of bone structures of the nose and paranasal sinuses skeleton requires fine cups and high resolution. Millimeter thick images obtained allow the study of teeth that are close to the alveolar recess of maxillary sinus which is very important in children in the period of growth. Tomodensitometric examination is essential for precise analysis of sinus opacification and integrity of the sinus walls (normal, thin, densified). CT image is required for viewing the anatomical elements, which serve landmarks in endoscopic examination and analysis of surgical areas with a high risk of complications (lamina papyracea of the ethmoid bone, lamina cribrosa, persistence of Haller and Onoda cells, report between the side wall with the internal carotid artery and optic nerve, etc.).

In the case of recurrent and chronic sinusitis in children, the computed topographic examination can detect predisposing or maintaining factors of inflammatory process of sinus mucosa such as different endonasal anatomical abnormalities and variations: septum deviation in different segments, concha bullosa, paradoxical turbinate, hypergenesis of uncinate apophysis and various forms of deviations, excessive pneumatization of ethmoid bulla, etc. [10]. Results and discussion

The study and analysis of CT images was crucial for detection and characterization of septal deviation in children in the study groups, as nasal septum deviation can block the ostiomeatal complex structures thus favoring the occurrence of inflammation. Computed tomography can determine the precise location and nature of the deviation (deformation, thickening or pneumatization of nasal septum). CT examination results showed a frequent finding of nasal septum deviation in patients of the study groups, with a caseload of 78 (65%) deviations. The deviations had a wide range of localizations: anterior segment - 37 (30.9%), posterior segment - 15 (12.5%) and septal deviation in the anteroposterior segment - 26 (21.7%).

In accordance with the studies on nose and paranasal sinuses physiology and pathophysiology, in emergence and further development of chronic inflammatory process of the paranasal sinuses a special place has the anatomical factor, particularly abnormalities and anatomical variants in the area of ostiomeatal complex

Paradoxically curved middle turbinate was determined in 24% cases, which corresponds to literature data showing a frequency of 5-37% (Fig. 2).

The results of our study have showed a frequency of 23 (19.1%) cases of Haller cells, being an anatomical factor (when they reach to 3 – 6 mm) in the development of ethmoidal sinusitis due to narrowing of infundibular space. Hiperpneumatization of Agger nasi cells have a major clinical importance, compressing the frontal recess and predisposing to frontal sinus inflammatory process. In our study it was detected in 17 (15.5%) cases. The CT examination performed on patients in our study determined pneumatization of ethmoid bulla in 94 cases (78.3%), a figure bigger than in the literature (17-65%) due to bilateral location of the anomaly.



Fig.1 Bilateral concha bullosa

Studying and analysing the CT image we paid particular attention to middle turbinates variations of presentation (concha bullosa, paradoxical turbinate), of the processus uncinatus, size of ethmoid bulla and Agger nasi cells, presence of Haller infraorbital cells. In our study the most common anatomic variant was concha bullosa detected in 65 patients (54.1%), prevailing in group III - 28 patients (70%) (Fig. 1).

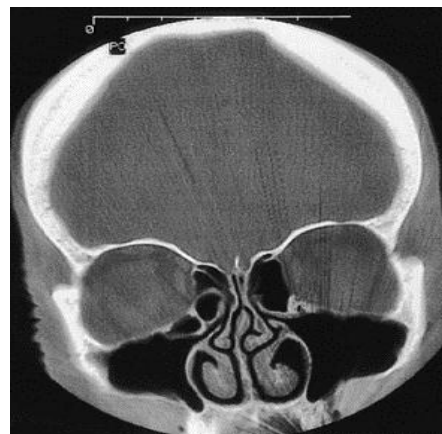


Fig.2 Paradoxically curved middle turbinate

Diverse anatomical variants of uncinate process were detected at CT examination in patients in the study groups: curvature of uncinate process - 21 (17.5%) and excessive pneunmatization of uncinate process - 69 (57.5%) (Table 1). Finally, we can conclude that the frequency of detection of anomalies and anatomical variations of the nasal passages is high in patients with recurrent and chronic inflammatory process of the paranasal sinuses.

#### CONCLUSION

CT examination shows an accurate evaluation of ostiomeatal complex structure, which is responsible for the persistence of recurrent and chronic sinus process, and is important in performing endoscopic surgery.

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