

RHINOLOGY

Nasal septal deformities in chronic rhinosinusitis patients: clinical and radiological aspects

Aspetti clinici e radiologici delle deformità del setto nasale in pazienti affetti da rinosinusite cronica

G. POJE¹, J.S. ZINREICH², N. SKITARELIĆ³, K. ĐURIĆ VUKOVIĆ¹, G.C. PASSÀLI⁴, D. PASSÀLI⁵, R. MLADINA¹

¹ Department of Otorhinolaryngology Head and Neck Surgery, Clinical Hospital Center Zagreb, Croatia, ² Division of Neuroradiology, Department of Radiology, The Johns Hopkins Hospital, Baltimore, USA, ³ Department of Otorhinolaryngology Head and Neck Surgery, General Hospital Zadar, Croatia, ⁴ ENT Clinic, Catholic University of the Sacred Heart, Rome, ⁵ Department of ORL Head and Neck Surgery, Policlinico Le Scotte, Siena, Italy

SUMMARY

Septal deformities are very frequent in patients suffering from chronic rhinosinusitis (CRS). The question is whether or not some types of septal deformities are involved more frequently in this process or not. The authors observed the incidence of particular types of septal deformities in a group of CRS patients using Mladina classification. The same has been done with a control group that consisted of healthy volunteers. In the literature, type 7 has been found very frequently, i.e. in nearly 30% of all CRS cases. Herein, type 7 was mostly composed of types 3 and 5. Type 3 can be accurately recognised on axial MSCT scans, while type 5 can be accurately recognised on coronal views. Concomitant septal surgery at the time of endoscopic sinus surgery is recommended.

KEY WORDS: Chronic rhinosinusitis • Nasal septum • Deformities • Incidence • Classification • MSCT

RIASSUNTO

Le deformità del setto nasale sono molto frequenti in pazienti affetti da rinosinusite cronica (CRS). La domanda è se alcune deformità possono aggravare più di altre questo processo patologico. In questo lavoro gli autori hanno studiato l'incidenza di particolari tipi di deformità in un gruppo di pazienti affetti da CRS usando la classificazione di Mladina. Lo stesso è stato fatto in un gruppo di controllo costituito da volontari sani. Il tipo 7 molto è stato riscontrato nel 30% dei casi di CRS. Tale tipo risulta essere caratterizzato dalla presenza contemporanea di diverse deformità e più frequentemente dall'associazione del tipo 3 e 5. Il tipo 3 evidenziabile accuratamente con scansioni TC assiali ed il tipo 5 con scansioni coronali. Gli autori concludono sostenendo l'importanza e l'utilità di una settoplastica da eseguirsi, in pazienti, che presentano una deformazione tipo 7, in concomitanza con la FESS.

PAROLE CHIAVE: Rinosinusite cronica • Deformità del setto nasale • Esame TC

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Introduction

The influence of skull base shape on the onset of septal deformities of the human nose was first mentioned by Šercer as early as 1936¹. This author stated that septal deformities could not be found in quadrupeds since their skull base is flat, i.e. does not have any angulation at the junction of its anterior and posterior part. On the contrary, the skull base of the adult humans is angulated by an angle open downwards, i.e. towards the splanchnocranium (Huxley's angle). An approximate value of Huxley's angle is 135°. According to Šercer's opinion at that time, the angulation of the skull base results from a downward pressure of the neurocranium

onto the splanchnocranium, hence causing septal deformities. Šercer called this system "cranial pincers". He also drew the attention to the fact that in newborns and small children the skull base has no angulation, but with age it gradually becomes increasingly angulated until it reaches its final shape in an adult age. This is clinically and practically supported by the fact that the incidence of septal deformities in newborns varies from 0.9% to 17%^{2,3}, gradually rising in small children, and continuously rising with age it finally reaches some 55% of all young adults (19-20 yr of age)⁴. A reduction of the splanchnocranium at the expense of neurocranium has also been noted, thus resulting in a prominent nose in mankind⁵.

On the other hand, chronic rhinosinusitis (CRS) is a very common clinical entity. Everyday experience teaches us that septal deformities are very frequent in patients suffering from CRS. There are many reports in the literature dealing with the correlation between septal deformities and CRS, but few actually demonstrating such a correlation, thus suggesting that the correlation is perhaps not that strong and important⁶⁻⁹. The question arises here as to whether previous results are biased as because they were not based on a well defined classification of septal deformities. Our interest was whether or not some particular, targeted septal deformities are involved more frequently in this process.

To elucidate this, we needed a clear classification system. For instance, a practical and user-friendly classification of septal deformities would serve to make data standardised, uniformed, reliable and comparable. The Mladina classification¹⁰ is such a system.

One should take into consideration that not all septal deformities can be recognised during native anterior rhinoscopy, since very posterior deformities could be simply hidden behind the more anterior anatomical parts of the nasal cavity. For this reason, decongestion and endoscopic examination of the nose are needed for reliable assessment of the possible existence of septal deformities.

The aim of this comparative study was to elucidate whether or not some particular types of septal deformities are more frequent in CRS patients.

Our multicentre study, based on native anterior rhinoscopy findings of the nose with no decongestion or even endoscopy of the nasal cavity, showed that the overall incidence of septal deformities in adult humans is very high, near 90% of the population in the world¹¹. Since neither decongestion of the nasal mucosa nor nasal endoscopy were performed in that study, it could be expected that some of the so-called deep deformities remained undiscovered. This gives rise to the belief that the incidence of septal deformities in adult subjects is even higher than 90%. This finding gave rise to the assumption that septal deformities are a very common clinical entity regardless of geographical distances and locations.

Materials and methods

A group of 127 CRS patients, older than 18 yr, suffering from CRS according to EPOS criteria¹² were recruited. The EPOS 2012 criteria were used as to define a diagnosis of CRS, i.e. first of all founded on anamnestic data, clinical findings (anterior rhinoscopy before and after the decongestion, fibre endoscopy) and MSCT scans in coronal and axial projections. Previously-operated patients were excluded from the study.

All participants were patients of the ENT Department of Clinical Hospital Center Zagreb, Croatia (89 patients), or ENT Department ORL Department of Policlinico Le

Scotte, Sienna, Italy (38 patients), admitted to the hospital because of sinus surgery in the period from September 2010 - September 2012. There were 78 males and 49 females, aged 18-73 yr. In both clinics, data were collected by two experienced rhinologists to ensure uniformity, relevance and reliability of the rhinoscopic and fibre endoscopic findings, as well as proper use of the Mladina classification both during physical examination (rhinoscopies, fibre endoscopy) and when assessing the appearance of nasal septums on MSCT scans.

As for the control group, the same procedures (except MSCT scans) were performed on 64 healthy volunteers with no clinical signs of CRS. There were no statistically significant differences between the CRS and control groups regarding the age and sex characteristics. All participants signed an inform consent form, and the study was approved by the relative Ethic Committees of Clinical Hospital Zagreb and Policlinico Le Scotte Siena, Italy. Statistical analysis of data collected in each centre was made with a Chi square test.

Mladina classification

There are seven types of septal deformities in this classification (Fig. 1). The first four belong to the so-called vertical deformities, meaning that deflections of the septum are defined by the sagittal plane (anterior-posterior deformities). The first two are located in the anterior valve region (type 1 and 2), the third is located next to the head of the middle turbinate, i.e. at the borderline between quadrangular and perpendicular lamina of the septal skeleton (type 3, otherwise named as "C-shaped" or "reverse C-shaped" septum). The fourth, type 4, is a double vertical deformity, i.e. it consists of type 2 on one side and type 3 on the other, thus forming so called "S" or "Z" shaped septum.

Type 5 means the unilateral basal, ascendant crest. It is located more laterally and deeper, and extends towards the lateral nasal wall (the so-called septal spur). The opposite septal side is almost always flat.

Type 6 is a unique deformity characterised by a groove between the septal cartilage and the intermaxillary bone wing. On the corresponding location of the opposite septal side, a more or less emphasised basal crest can be found.

Finally, type 7 is a variable combination of types 1-6.

Results

There were no differences in the incidence of subjects with and without a septal deformity between Italian and Croatian CRS groups (Table I). The incidence of type 7 was found to be statistically significantly higher in the group of CRS patients than in the control group (Table II). In the CRS group, it was present in almost 30% of subjects.

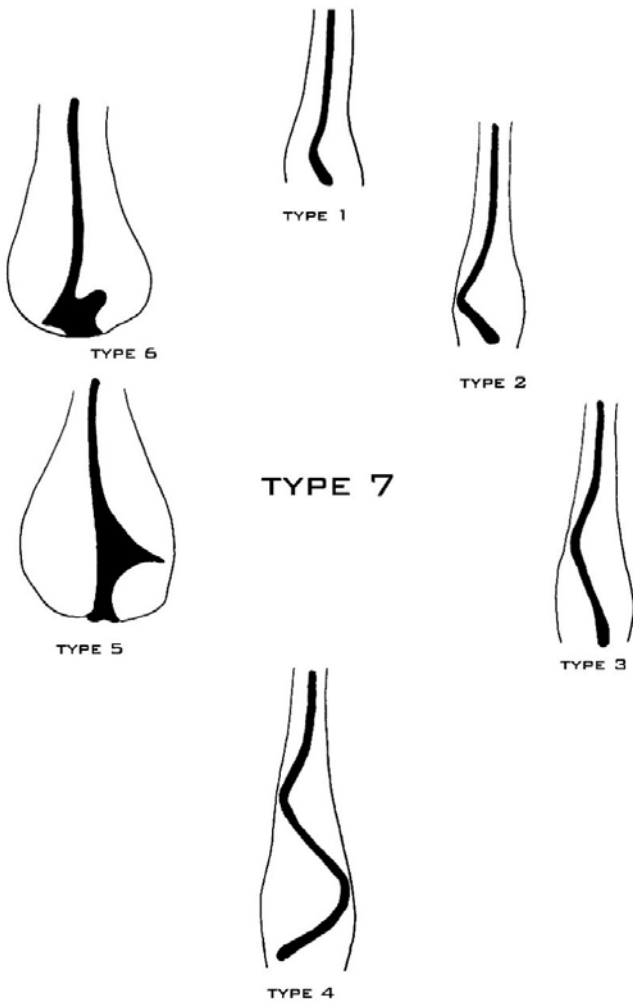


Fig. 1. Mladina classification. Types 1, 2, 3 and 4 are presented as in a bird's eye view, while type 5 and 6 are presented in an anterior-posterior view. Radiologically, the bird's eye view corresponds to axial CT scans, whereas the anterior-posterior view corresponds to coronal scans. Type 7 is in the middle of the scheme since it presents a combination of previous six types.

Type 7 is in fact a combination of some pure types of the deformities. It is well known that it usually consists of one of the so-called horizontal deformities (type 5 or 6) and one or more of the vertical deformities (types 1, 2, 3, or 4). Type 7 herein was mostly composed of types 3 and 5 (76.32%), than of types 3 and 6 (13.16%) and finally of types 2 and 5 (10.52%) (Fig. 2).

However, type 7 as a combination of some of the pure types, was not found to be the leading deformity in CRS group in general. It was present in almost one-third of those patients (29.92%), but the rest was represented by other, pure types of deformities such as: type 1 in 1.53%, type 2 in 3.05%, type 3 in 21.63%, type 4 in 6.15%, type 5 in 36.18% and type 6 in 1.53%.

Considering the incidence of type 7 in CRS group, it is obvious that the combinations that included type 5 were dominant, i.e. they were present in 86.84% of those types 7.

Table I. Incidence of septal deformities in Italian and Croatian CRS patients.

	Italy	Croatia	Statistical significance
Patients with nasal septal deformity	35 (92.10%)	81 (91.01%)	$p > 0.05$
Patients without nasal septal deformity	3 (7.90%)	8 (8.99%)	
Total number of patients	38 (100%)	89 (100%)	

Table II. The incidence of type 7 septal deformity in the CRS and control groups.

	CRS group	Control group	Statistical significance
Type 7 deformity	38 (29.92%)	4 (6.25%)	$p < 0.05$
No type 7 deformity	89 (70.07%)	60 (93.75%)	
Total number of patients	127 (100%)	64 (100%)	

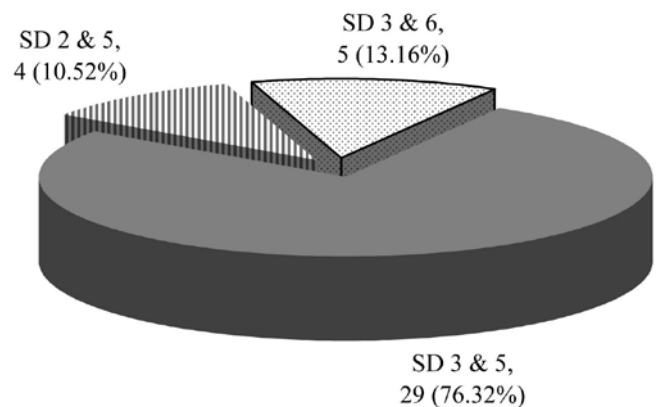


Fig. 2. The percentages of various types of septal deformities (SD) in type 7 found in CRS patients.

Radiologically, the most common types of septal deformities in CRS patients are quite easily recognisable. For instance, type 3 is a typical unilateral septal deformity, the so-called “C-shaped” or “reverse C-shaped” septum. The angulation of the deformity is located exactly at the borderline between the quadrangular and perpendicular lamina of the septal skeleton. Thus, it belongs to the group of “vertical deformities”, i.e. those which concern the declinations of the septum in a sagittal plane, and is thus expected to be clearly presented and seen almost exclusively on axial MSCT scans (Fig. 3 A and B). On the other hand, type 5 definitely belongs to horizontal deformities. The deflection here does not go anterior or posterior as in types 1, 2, 3 and 4, but laterally. Because of this, type 5 as far as the MSCT is concerned, should be exclusively observed and studied by coronal scans because of its typical clinical appearance (Fig. 4 A and B).

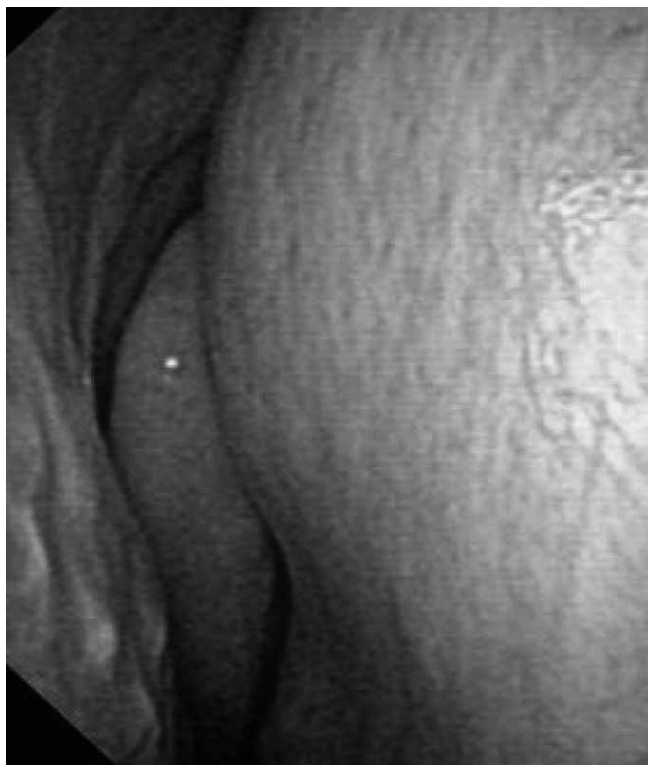


Fig. 3A. Moderate, right-sided type 3. Only lateral and inferior half of the middle turbinate can be seen after decongestion.



Fig. 3B. An axial MSCT scan of the same patient shown in Figure 3A, showing nasal septum anatomy: it is deflected at the borderline between the cartilaginous and bony septal skeleton, getting into close contact to the head of the right middle turbinate and making right nasal cavity remarkably narrower than the left one.

Discussion

A lasting question on the role of the septal deformities in CRS has been evaluated herein in a practical and clear manner: a well established international classification of septal deformities has been used in two independent CRS groups, and the results compared to a well defined

control group. It was found that one of the vertical septal deformities, i.e. deformity in antero-posterior direction, was predominant. Namely, type 3, which, owing to the fact that the most prominent part of the deformity lies in the close vicinity of the head of the middle turbinate, makes one nasal cavity remarkably narrower than the other. The turbulent flow of the air-stream, which occurs



Fig. 4A. Right-sided type 5 septal deformity.



Fig. 4B. Type 5. A coronal MSCT image perfectly identifies type 5 in all cases, with no exception. Axial CT-scans are of less importance.

both because of narrow passage on one side and very wide passage on the other side, produces the epithelial metaplasia, i.e. respiratory epithelium usually becomes substituted by squamous cell epithelium¹³⁻¹⁴. In terms of paranasal sinus physiology, particularly in terms of normal functioning of the ostiomeatal complex, this is crucial fact: this leads directly to stasis of mucus, i.e. to long lasting, smouldering, subacute or even chronic inflammation, compromising the function and health of all sinus compartments around it: frontal, maxillary, sphenoid and ethmoidal⁷.

In addition, types 3 and 5 were found very often in the CRS group as one of the components of the otherwise frequently seen type 7.

Fortunately, this type is easily and accurately recognised when studying axial MSCT scans of the paranasal sinuses. At any rate, the second most frequent type in CRS patients was type 7, but again combined in more than two-thirds of cases of type 3 with a type 5. This was found more frequently in CRS group than in the control group (29.92% and 6.25%, respectively).

The question arises as to whether a clinician should pay attention to the septal deformities in CRS patients, and if concomitant septal surgery is warranted in addition to endoscopic sinus surgery?

In our opinion, the answer is 'yes'. Septal surgery, if performed properly, cannot produce anything negative for surgically-treated sinuses, and can only be beneficial. The duration of the surgery can be prolonged, but it is nonetheless of value since a straight septum will undoubtedly offer better aerodynamic preconditions for healthy sinuses than a deformed one.

Fortunately, septal deformities can be well recognised and accurately assessed even without rhinoscopy or fibre endoscopy of the nose by analysing MSCT scans in both axial and coronal projections. Since types 1, 2, 3 and 4 belong to the group of "vertical deformities", i.e. those which concern the declinations of the septum in a sagittal plane, they can be clearly and accurately seen and correctly recognised almost exclusively on axial MSCT scans. Coronal scans, in the case of these deformities, can allow an experienced rhinologist to get a general idea about septal morphology and the wideness of both nasal cavities, but the lateral deflections can be observed much more clearly only on axial scans only. Beyond doubt, coronal scans will show that the ipsilateral nasal cavity, where there is the septal convexity, is generally narrower than the other one.

It should be kept in mind that the irregularity cannot be reliably recognised as a type 1, 2 or type 3 since the only difference between these three types lies in the fact that types 1 and 2 are located in the region of the anterior nasal valve, while type 3 is located deeper in the nose, i.e. next to the borderline between septal cartilage and perpendicular lamina facing the head of the middle turbinate. Looking at coronal MSCT scans from anterior to poste-

rior, they may give almost the same impression with the possibility to substantially confuse the observer.

Regarding types 5 and 6, two aspects are important: first, these deformities definitely belong to horizontal deformities. The deflections do not go anterior or posterior as in types 1, 2, 3 and 4, but laterally. On occasion, only the unilateral deflection can be visible, like in type 5, or the deflection involves both sides, as in type 6. Regardless, types 5 and 6, as far as MSCT is concerned, should be exclusively observed and studied by coronal scans because of their typical clinical appearance.

Conclusions

Septal deformities according to the Mladina classification can be accurately and easily recognised on MSCT of the paranasal sinuses. Type 3 can be accurately recognised on axial MSCT scans, while type 5 can be accurately recognised on coronal ones. Type 7 is found very frequently, i.e. in nearly 30% of all CRS cases. Herein, type 7 was mostly composed of types 3 and 5.

Concomitant septal surgery at the time of endoscopic sinus surgery is recommended.

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