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The influence of the caudal process on the formation of septal deformities

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SUMMARY

The aim of the paper was to confirm the variations in the length of the caudal process and its relationship to the skull shape (occipitopetal or frontopetal) in various pathological septal deformities according to Mladina's classification.
The length of the caudal process was measured during septal surgery in a group of 46 patients suffering from nasal obstructions caused by septal deformities. Measurements were made with an indirect method: the distance between the lower anterior rim of the pyriform aperture and the deepest point of the caudal process, which could still be surgically prepared, was taken as a function of its length (so called X-value). To establish the skull shape lateral cranial X-rays were made for each patient.
Certain types of septal deformities were found to be more frequent in patients with longer caudal processes (type 2 and 5), than in cases when they were shorter (type 1 and 6).
Twentyseven out of 46 patients were found to have frontopetal skulls, and X values were smaller than 3 cm. The occipitopetal skull shape was found in 19 patients whose values exceeded 3 cm.
Caudal process and the skull shape, therefore, may affect development of particular types of septal deformities.
Even more, it can be presumed that the septal response to trauma will depend upon some of these factors.

INTRODUCTION

Septal structure is characterized by tissue heterogeneity involving histological, embryological and anatomical variations of its nine integral components. (Takahashi, 1977; Wexler, 1977; Pirsig, 1986; Murray, 1987) (Figure 1). The caudal process of the quadrangular lamina has a central position in the mosaic

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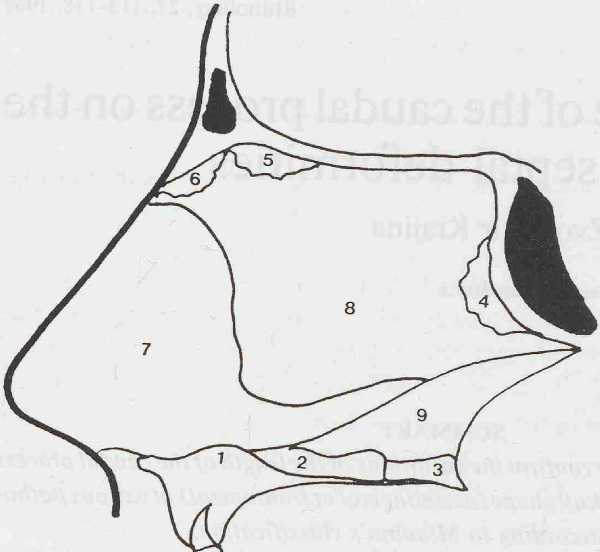


Figure 1. The mosaic structure of the nasal septum. 1. Intermaxillar bone, 2. Crista nasalis of maxillar processus palatinus, 3. Crista nasalis belonging to lamina horizontalis of the palatal bone, 4. Rostrum sphenoidalis, 5. Crista nasalis of the frontal bone, 6. Crista nasalis of the nasal bones, 7. Quadrangular lamina, 8. Perpendicular lamina of ethmoidal bone, 9. Vomer.

structure of the septal skeleton. It is placed between the lower edge of the perpendicular lamina and the upper rim of vomer and is always parallel to the spheno-alveolar axis. Its length varies. This cartilaginous baton participates in hemming the edges of bone septal parts in cases of horizontal deformities. Takahashi (1977) stressed out the importance of the caudal process. He found that the septal deformity was as stronger as the caudal process was shorter, but no particular attention was paid to the type of the deformity (either horizontal or vertical, for example).

Our observations confirmed the relationship between the various lengths of the caudal process and certain types of pathological septal deformities. We also studied the skull configuration (divided into frontopetal and occipitopetal shapes), and results were compared to the previous two parameters.

METHODS AND MATERIAL

The length of the caudal process was measured during septal surgery in a group of 46 patients suffering from nasal breathing difficulties caused by various septal deformities. There were 30 males and 16 females, aged from 16 to 56 years. Various types of septal deformities were represented. They were systematized according to Mladina's classification (1987):

Type 1 (10 cases): A vertical ridge in the valve area which never reaches nasal dorsum, and does not disturb the valve function.

Type 2 (7 cases):	A more definite vertical ridge in valve area. It always reaches the dorsum and in that way disturbs normal valve function.
Type 3 (2 cases):	A vertical ridge in deeper areas, i.e. area 3 and 4 after Cottle. It reaches the nasal dorsum.
Type 4 (1 case):	Two vertical ridges reaching nasal dorsum, one in the valve area and the other 2–3 cm backwards and to the opposite side from the first one.
Type 5 (7 cases):	So called "sabre septum" because of horizontal ridge resembling the ancient Turkish sabre. This ridge begins from the distal part of the intermaxillar bone wings and rises towards the lateral nasal wall and backward, becoming larger and larger as it gets deeper.
Type 6 (14 cases):	Two horizontal ridges, one medial and the other lateral. The lateral one rises from the proximal part of the intermaxillar bone wings and reaches its most expressive shape in the third Cottle's area, but never sticking out so much, slightly diminishing in deeper areas. This ridge is always followed by the corresponding deep gutter on the opposite side of the septum.
Type 7 (5 cases):	So called "crumpled septum". This type consists of a number of planes lying in various angles with each other, several curves, ridges etc. Usually this is a combination of some previously described types of septum deformities.

All patients underwent a routine preoperative procedure including anterior rhinomanometry (NR 6 System, Mercury, Electronics Scotland Ltd.), X-rays of the paranasal sinuses, cytological examinations of the mucosal surface, and saccharin test for nasal clearance. Measurements were done with an indirect method: the distance between the lower anterior rim of the pyriform aperture and the deepest point of the caudal process which was still surgically feasible (preparable) was taken as a function of this length (so called X-value). After marking the distance at the instrument used at the moment, it was transferred to a ruler scale. To establish the skull shape the lateral cranial X-rays were performed in each patient (Figure 2).

RESULTS

It was found that certain types of septal deformities appeared more frequently in patients with longer caudal process (type 2 and 5) than in cases where it was shorter (Type 1 and 6). Furthermore, in 27 out of 46 patients the frontopetal skulls were found to have X-values smaller than 3 cm. The occipitopetal skull shape was found in 19 patients whose X-values exceeded 3 cm (Table 1).

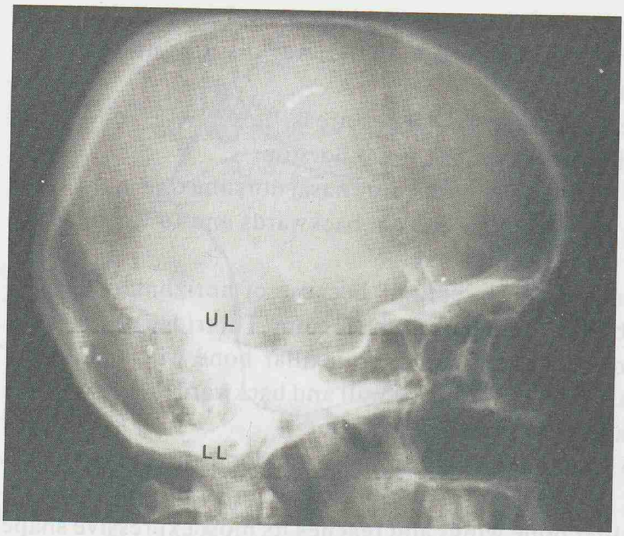
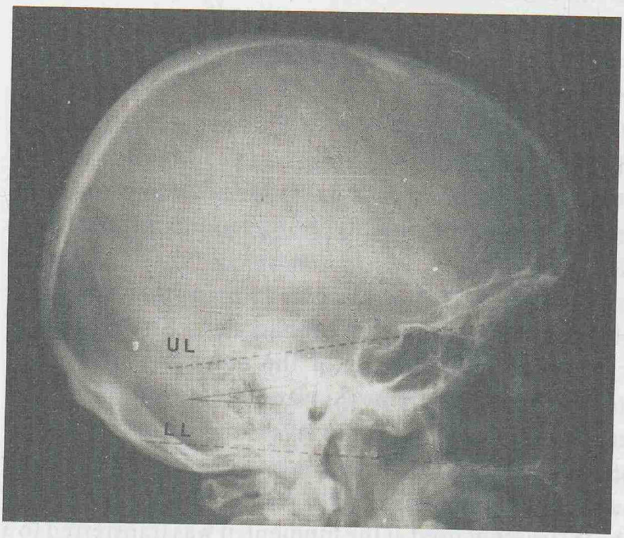


Figure 2. Skull shapes
UL: upper line which connects two points: nasofrontal suture and the centre of the fossa hypophiseos.
LL: lower line which passes through the palatal plane. These two lines are almost parallel in frontopetally shaped skulls, or make an angle in occipitopetally shaped skulls.

a. A frontopetally shaped skull.



b. An occipitopetally shaped skull.

Table 1. The relationship between skull shape, the length of the caudal process and appearance of certain types of pathological septal deformities.

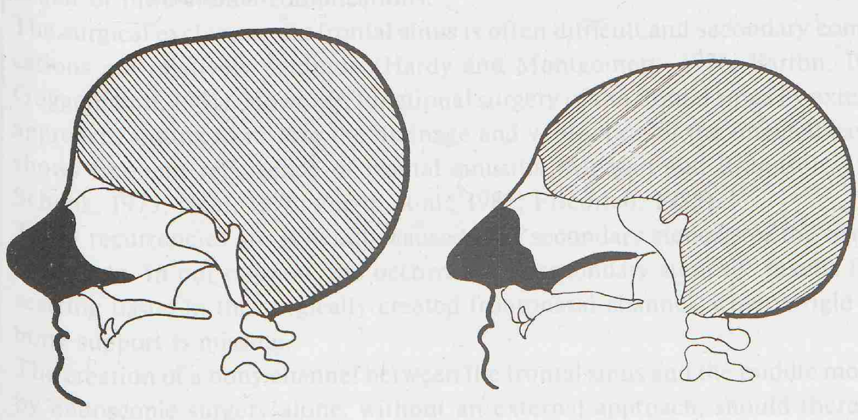
	Types							
	1	2	3	4	5	6	7	total
Frontopetal: x<3 cm	9	1	0	1	0	13	3	27
Occipitopetal: x>3 cm	1	6	2	0	7	1	2	19

DISCUSSION

The characteristics of the relationship between neurocranial and splanchnocranial spaces of the skull skeleton were established a long time ago (Takahashi, 1977).

Based upon our results we can anticipate shorter caudal process in individuals with frontopetal skull shape. In addition, it seems that so called cranial wrench (Figure 3a , b) in frontopetal skulls offers too little room for the backward growth of the caudal process indirectly diminishing the possibility for development of some types of pathological septal deformities, such as type 2 and 5.

As types 1 and 6 differ very much in morphology and etiology, the question arises whether there is any relation between them since we found them almost equally frequent in cases with short caudal process. As type 1 usually concerns the trauma against the nose, we can presume that shortness of the caudal process provides the septum's stability and resistance against violence and in that way prevents more emphasized septal deformities to happen. Probably that is why type 2 does not occur frequently in cases with a short caudal process and vice versa. The shorter the caudal process the fewer the possibilities for dislocation of the vomero-ethmoidal septal edge. Furthermore, it seems that in case of disturbed growth of the orofacial skeleton or the upper jaw, a short caudal process will lead to type 6 of septal deformities. On the contrary, a too long caudal process will allow the development of the basal hondrooseal crista without a corresponding gutter in the opposite side of the septum (type 5) because of an enhanced possibility for the movements of the entire quadrangular lamina in case of various types of violence activity against the nose.



a. b.

Figure 3. a. A frontopetally shaped skull does not leave enough room for the backward growth of the caudal process. b. The local situation is opposite hereby: there is enough room for the backward growth of the caudal process.

Of course, the caudal process is but one of a number of factors affecting the development of pathological septal deformities. Some of the factors are as follows: direction and intensity of violence, general resistance of the nasal tissues and the most important, morphology of the upper jaw.

We may conclude that among important factors which can influence the development of the pathological septal deformities in man, whether they be caused by trauma or not, some of them must be especially emphasized. These are the length of the caudal process, regular upper jaw morphology and skull shape.

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