

# The value of high-resolution CT-scan for diagnosis of infectious paranasal sinuses disease and endonasal surgery

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## SUMMARY

*Since 1986 the high resolution CT in two planes is part of four preoperative diagnostic program for patients with chronic rhinosinusitis, acute, complicated rhinosinusitis and polyposis nasi. The importance of the CT for diagnosis, localization, and planning the operation shall be demonstrated.*

## INTRODUCTION

The revival of endonasal microsurgery is not only a result of better physiological and anatomical knowledge, better instruments and operation techniques but is also influenced by a progress in radiological diagnostic CT scan. 158 patients with infectious diseases of the paranasal sinuses from 1987-1989 underwent a diagnostic CT-scan. 137 patients were operated while 20 of those had undergone previous surgery. The mean age of the patients were 40.8 years. The youngest was eight years, the oldest 81 years. Most of the CT scans were performed by a Picker Synerview 1200 SX, a minor number was done by a Siemens Somatom Plus VAB 1. Coronal sections are cut all 2-4 mm as well as axial cuts with the patient in prone position. The window range was 4000 HE. The centre was laid at +600 HE. Only accurate definition of the window range and centre will result in reliable and diagnostic valuable scans. Thence, it is possible to see all important structures of the lateral nasal wall and related structures of the orbit and skull base.

## NORMAL FINDINGS

The CT scan of an healthy person will show bone as white matter or lamella with a fine, scarcely visible grey line as mucoperiost. From front to rear the coronal

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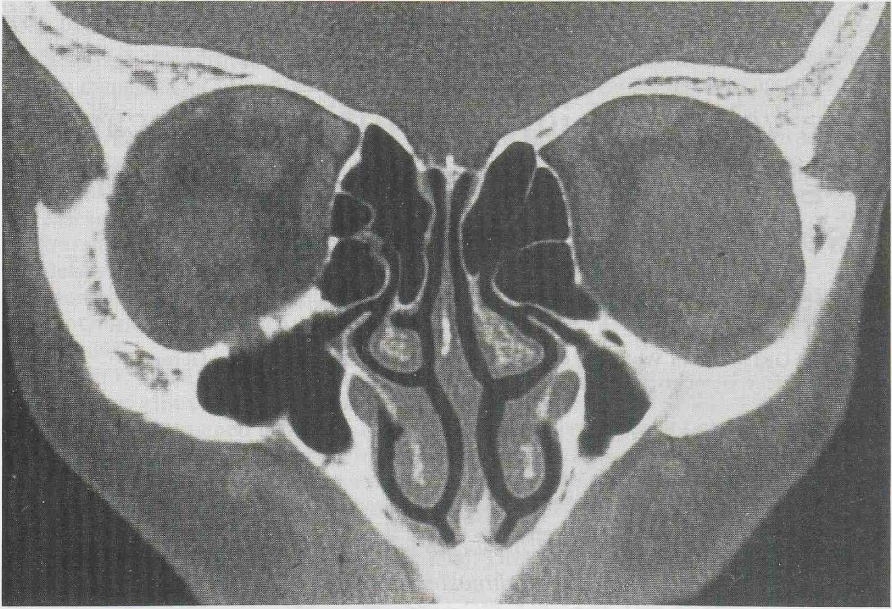


Figure 1a. Coronal computed tomogram of a healthy person, which shows the delicate ostiomeatal unit. Bulla ethmoidalis, processus uncinatus, lamina papyracea and lamina cribriformis can be demonstrated.

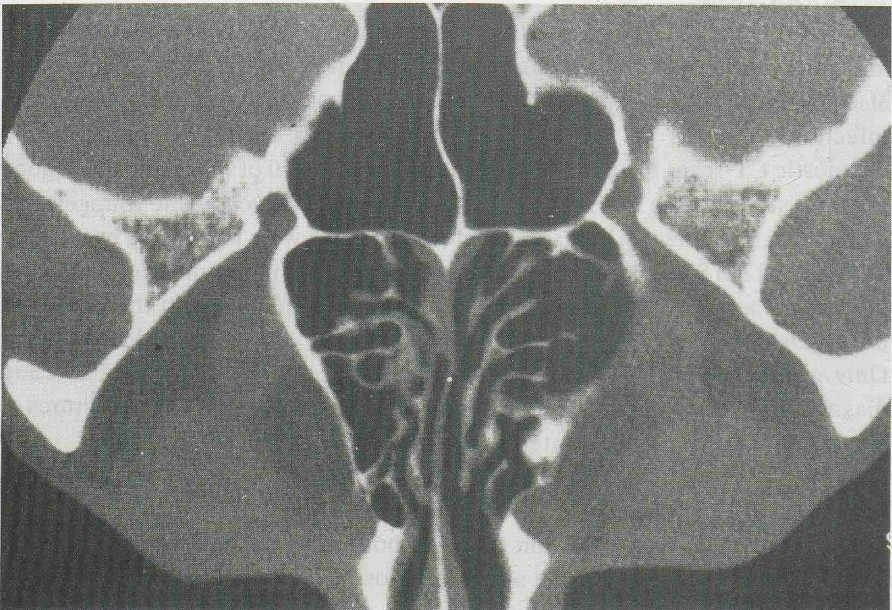


Figure 1b. Axial computed tomogram of the same person. The pyramidal structure of the ethmoid is well visualized and the bony canal of the carotid artery in the lateral wall of the sphenoid sinus.



sections will show frontal sinus and infundibulum frontale, anterior ethmoid with the uncinete process, hiatus semilunaris and turbinates. Finally the sinus maxillaris, posterior ethmoid and sphenoid will be shown (Figure 1a). In all coronal sections the skull base and lamina papyracea can be identified. In the axial cuts the total architecture of the ethmoid and the important relation of optic nerve and carotid artery to the ethmoid and sphenoid will be visualized (Figure 1b).

## RESULTS

### *Chronic rhinosinusitis*

A total of 123 patients (100%) with history of chronic rhinosinusitis underwent a computed tomogram. Of these, 102 (82%) of the CT scans showed pathologic mucosal findings, in 21 of the cases (18%) there were no pathologic findings that needed to be operated on.

The anterior ethmoid was in 102 cases (82%) abnormal, in 70 cases bilaterally and in 32 cases unilaterally. The maxillary sinus in second place showed in 79 cases (64%) pathologic mucosa swellings, 54 cases bilaterally and 25 cases unilaterally (Figures 2a, b).



Figure 2a. Coronal computed tomogram of a patient with right-sided, unilateral chronic rhinosinusitis. The ostiomeatal complex shows abnormal mucosal swelling; ethmoidal cells and maxillary sinus are involved in the disease.

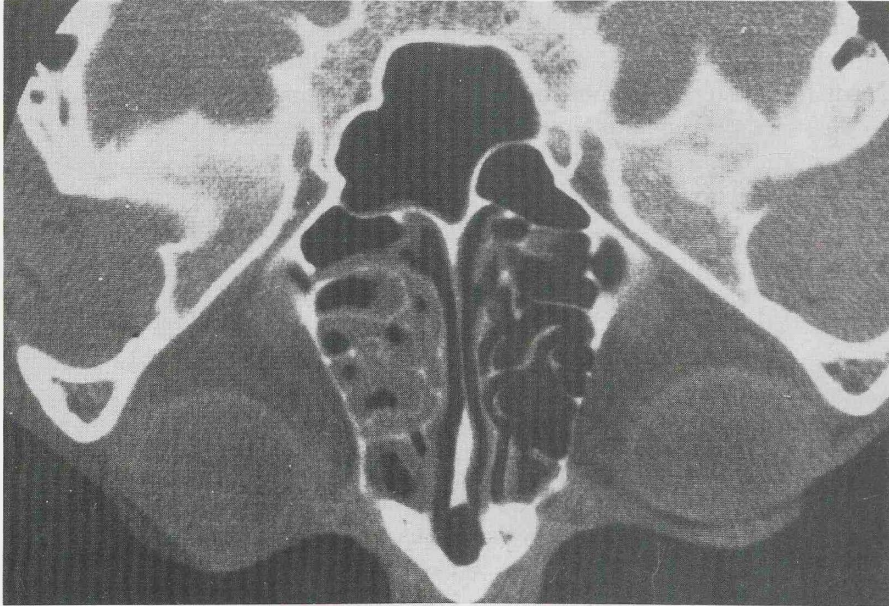


Figure 2b. Axial computed tomogram of the same patient. The inflammatory disease is confined to the ethmoidal cells.

The posterior ethmoid was involved in 54 cases (44%); 29 times bilaterally and 25 unilaterally. The frontal sinus was affected in 30 cases (24%); 21 times bilaterally and nine unilaterally.

The sphenoid sinus showed only in 27 cases (21 %) abnormal mucosal findings; 16 cases bilaterally and 11 unilaterally.

The pathological reaction in chronic rhinosinusitis seems to be confined to the mucoperiost.

#### *Acute, complicated rhinosinusitis*

Twelve (100%) CT scans of patients with acute, complicated rhinosinusitis were examined. In eight (66,7%) anterior ethmoid, posterior ethmoid and sinus maxillaris were together affected most often unilaterally, six cases unilaterally and two cases bilaterally. In six cases 50% the sinus frontalis was involved; five cases unilaterally and two cases bilaterally (Figure 3).

The sphenoid sinus showed in four cases (33,3%) abnormal mucoperiost, in three cases unilaterally and one bilaterally.

In four patients the inflammation was primarily confined to the sphenoid; three times unilaterally and one time bilaterally, while in one case there was an involvement of the posterior ethmoid.



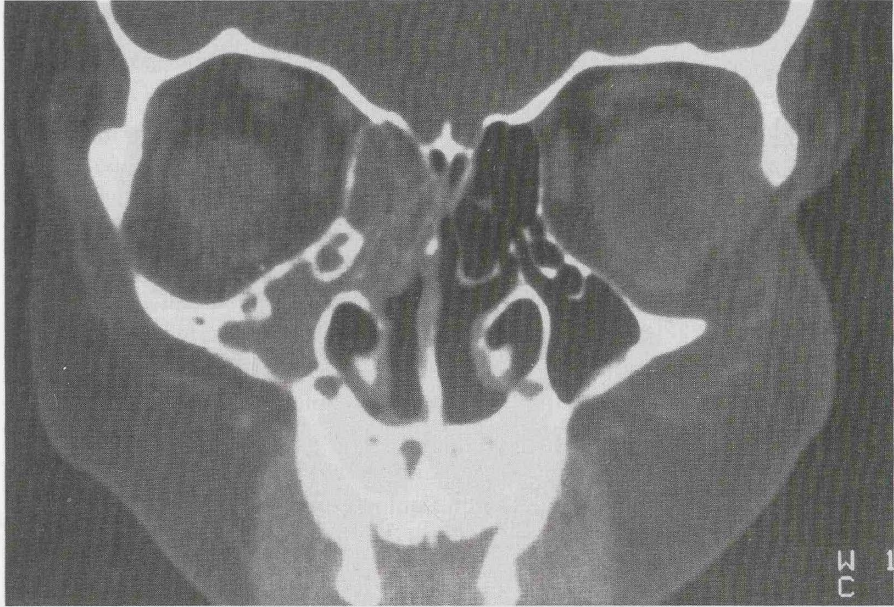


Figure 3 Coronal computed tomogram of a patient with acute, complicated unilateral rhinosinusitis on the right side. Total opacification of the ostiomeatal complex, ethmoidal cells and maxillary sinus by the inflammatory process. Periorbital oedema on the right side.

#### *Polyposis nasi*

In all 23 patients (100%) with polyposis nasi the anterior ethmoid was obstructed by polyps; 21 cases bilaterally and two cases unilaterally. The maxillary sinus showed in 22 cases (95.6%) pathological mucosa formation; 20 cases bilaterally and two cases unilaterally. The frontal sinus was affected in 20 cases (86.9%); 18 cases bilaterally and two unilaterally.

The sphenoid sinus showed pathological mucoperiost formation in 17 cases (73.8%); 16 cases bilaterally and one case unilaterally. Ten patients had been operated before (Figures 4a, b).

#### DISCUSSION

This study reveals that in chronic rhinosinusitis the anterior ethmoid shows the highest incidence of abnormal mucosal formations. Then follows the sinus maxillaris, the frontal sinus, the posterior ethmoid and sphenoid sinus. These results are in accordance with the work of Zinnreich et al. (1987). In our patients there were in 17% no abnormal findings in the paranasal sinuses. Mann et al. (1987) found even in 30% no involvement of the anterior ethmoid.

It is important to mention that the CT scan visualizes the paranasal sinuses only at a certain point of time. Moreover, immunological and allergic diseases can

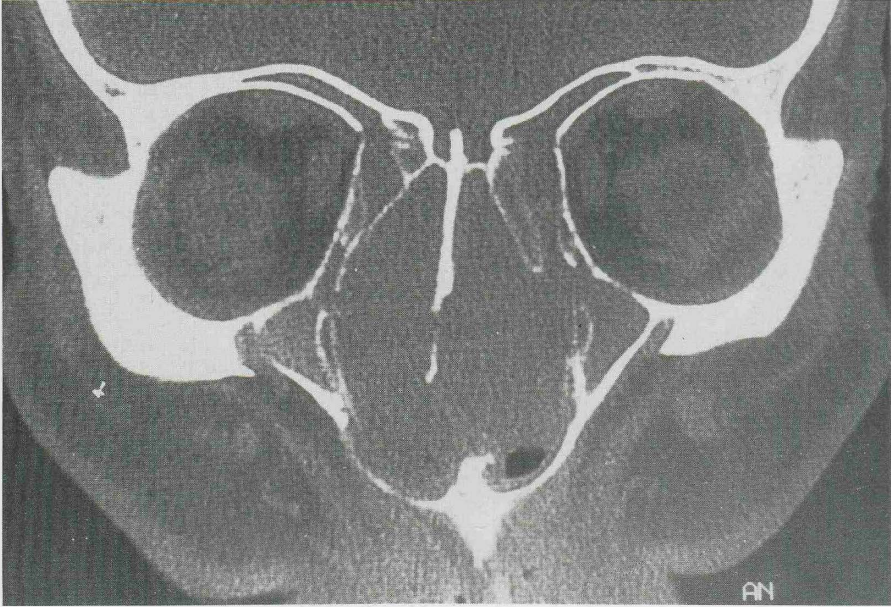


Figure 4a. Coronal computed tomogram of a patient with massive polyposis nasi. Polyps fill the nasal cavity and compress the ostiomeatal unit. The polyps obliterate the paranasal sinuses.

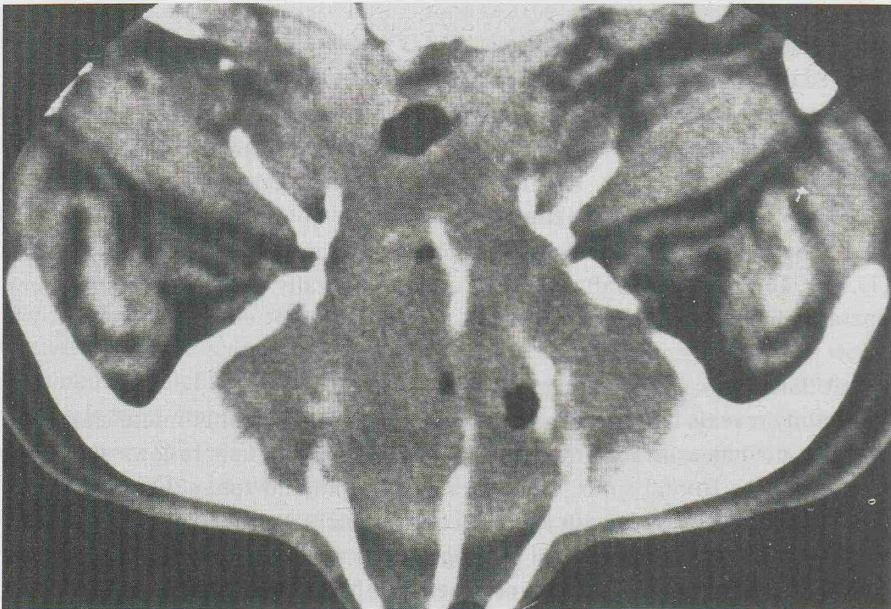


Figure 4b. Axial computed tomogram of the same patient. There is an erosion of the lateral maxillary wall visible.



cause symptoms that can mimic a chronic rhinosinusitis but one will miss a radiological correlate. In acute rhinosinusitis the CT scan is essential to evaluate complications and for planning the operation (Mees and Vogel, 1989).

The anterior ethmoid is in polyposis nasi the most often affected area with regard to the polyp formation. The maxillary sinus is nearly as often involved. The tendency of generalization of the mucosal disease is not only demonstrated by the high percentage of involvement of all other sinuses but also by the typical bilateral formation of polyps in the nose (Ganz, 1985).

The central importance of the ethmoid for diseases of paranasal sinuses is generally accepted (Messerklinger, 1982; Stammberger, 1987). By an infection the mucociliary clearance is disturbed, mucosa! swelling and secrete retention is caused. Usually the normal mucociliary function can be restored.

In the clefts of the middle meatus with its anatomical narrow spaces infectious foci can persist and cause recurrent sinusitis (Messerklinger, 1982, 1987; Wigand, 1981). In addition to pathophysiological thoughts, it is important to learn that a high incidence of anatomical variants have been described (van Alyea, 1939; Lang, 1988). From the middle meatus derive suprabullar, and infundibular cells (van Alyea, 1939), and even posterolateral cells which should be seen in connection with the high incidence of infections in the anterior ethmoid. We believe that the different distribution of the disease can thereby be well explained.

Beside the variations in the anterior ethmoid there are variations in the posterior ethmoid (van Alyea, 1939; Lang, 1988). Sometimes the optic nerve can be wrapped by a posterior lateral ethmoidal cell, so-called Onodi cell.

One should keep in mind that there are dehiscences in the bony wall of the carotid artery and optic nerve in the sphenoid sinus.

In conclusion the high-resolution CT-scan in two planes is for an ENT-specialist of the utmost importance because it is the only radiological means which clearly visualizes the complex paranasal sinus and the relation to vital neighbour structures. The rhinosurgeon can localize the disease and define its extension. Mechanical obstructions and important variations can be identified pre-operatively. All these factors help the ENT-specialist to perform a functional endonasal microsurgery.

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