



## Paranasal Computed Tomography Scan and Acute Rhinosinusitis

Jens Georg Hansen\*

Specialist in General Medicine, Aalborg Hospital, Aarhus University Hospital, Denmark

This short review is based on a previous article (thesis) entitled Acute rhinosinusitis (ARS). Diagnosis and treatment of adults in general practice [1]. Computed tomography scan (CT) of the sinuses is often considered to be the diagnostic test of choice, and has been the subject of several studies [2,3]. However, there have been conflicting reports about the correlation between sinonasal symptoms and CT evidence of acute rhinosinusitis [4,5]. In this short review I will focus on the routine use of CT and the association between CT, the bacteriological findings and the concentration of C-reactive protein and erythrocyte sedimentation rate. Based on previous reported data I will demonstrate new associations not published before.

### Clinical Use of CT in the Diagnose of ARS

Acute rhino sinusitis (ARS) is often diagnosed in primary care [1]. Several studies have confirmed that the diagnosis is difficult, and that this clinical insecurity is a great problem [6]. Computed tomography (CT) of the sinuses may be the diagnostic test of choice, and is used in this way in many studies. Beside CT is also especially valuable for visualizing all the sinus regions, if wanted [2,3]. Yet there are varying reports of both positive and negative correlation between sino-nasal symptoms and CT evidence of rhinosinusitis [4,5]. CT should not be regarded as the primary step in the diagnosis of ARS, except when there are unilateral signs and symptoms or other sinister signs, and after failure of medical therapy. Furthermore CT can be used in very severe disease, in immuno-compromised patients, when there is suspicion of complications [5]. But considering that the majority of patients in primary care is less ill, and that the number of complications are very low compared to patients referred to an ENT specialist or hospitals it seems that routine CT in general practice adds little useful information [1,5]. Furthermore there will be waiting time for the examination at the hospital.

In order to reduce the number of patients treated with antibiotics and thereby reduce the risk of antibiotic resistance it is important that GP's have convenient methods to discriminate between bacterial ARS and non-bacterial condition. In this scenario it looks like that CT has only very limited usefulness. Furthermore there are reports of both positive and negative correlation between sinonasal symptoms and CT evidence of purulent ARS. In two studies including 100 and 666 patients who were referred for CT for non-sinus related problems it was found that respectively 27% and 42% had sinus opacification. On this basis it is important to correlate the clinical examination to interpreting CT scans [7,8].

### CT and Culture-proven ARS

CT is the preferred diagnostic test, also in most scientific studies because it can show even minor pathological changes in the sinuses, compared to X-ray. The limitation of the interpretation is that the examination cannot determine whether retained secretions are purulent or serous. The predominant bacterial pathogens in ARS is *Haemophilus influenzae* and *Streptococcus pneumoniae* (Table 1).

The abnormalities in CT scans in patients with sinonasal symptoms are mucosal swelling and or the presence of fluid leading to total opacification. It is therefore an interesting question whether CT abnormalities can discriminate between these and different bacterial species (other species are only found in limited numbers)? As it can

Species	Positive CT	Negative CT	RR (95% CI)
+ <i>S. pneumoniae</i>	26	0	1,02 (0,99-1,06) p=0,15
- <i>S. pneumoniae</i>	81	2	
Total	107	2	
+ <i>H. influenzae</i>	22	1	0,98 (0,98-1,07) p=0,65
- <i>H. influenzae</i>	85	2	
Total	107	3	

RR= Relative risk

**Table 1:** Association of CT with culture for *Streptococcus pneumoniae* and *Haemophilus influenzae* from one or two sinuses.

be seen from Table 1 we were not able to demonstrate an association between cultures for neither *Haemophilus influenzae* nor *Streptococcus pneumoniae* and the result from CT. Searching the literature we did not find any published studies confirming or not conforming the result. We were not able to culture for viruses at the time (1992-1994) we performed these studies. CT scanning provides a detailed view of the paranasal sinuses. Although considered to be the radiologic investigation of choice in chronic rhinosinusitis, it is not normally used as an assessment tool for uncomplicated acute sinusitis. Moreover its limitations include a high frequency of abnormal scans in asymptomatic persons and the fact that CT cannot be used to distinguish viral from non-viral sinusitis [9].

### CT and Symptoms and Signs in Patients with ARS

70% of the patients with a clinical diagnosis of ARS had sinus affection on the CT [1]. In this way CT examination exclude 30% of patients suspected of the disease, and confirms that the disease is over-diagnosed in general practice. Pain in the sinus cavities occurring in 95% of patients. The only symptom associated to abnormal CT findings is purulent nasal discharge. C-reactive protein (CRP) and erythrocyte sedimentation rate (ERS) are both significantly and independently associated with pus in the sinus cavities and thereby changes on the CT [1]. This finding is surprising, because they are two nonspecific markers (Table 2).

Table 2 show the association between values of CRP and ERS and the changes in the CT. As it can be seen from the table there is a strong association between increasing values of both parameters and changes on the CT. Reanalysis of data has later on shown that the ROC curve for CRP combined with gender adjusted ESR only increases the area under the curve by 5%, and that the difference is not significant in relation to CRP alone. For this reason it is recommended that CRP alone is useful

\*Corresponding author: Jens Georg Hansen, Specialist in General Medicine, Aalborg Hospital, Aarhus University Hospital, Denmark, Tel: +45 98 16 58 65; Fax: +45 98 18 75 01; E-mail: [jensgeorg@dadlnet.dk](mailto:jensgeorg@dadlnet.dk)

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CRP mg/l	Positive CT	Negative CT	Total
>50	35	4	39
25-49	24	4	28
11-24	24	9	33
<10	38	38	76
<b>Total</b>	<b>121</b>	<b>55</b>	<b>176</b>
ERS mm/h			
>30	30	3	33
11/21-30	34	5	39
<11/21	57	47	104
<b>Total</b>	<b>121</b>	<b>55</b>	<b>176</b>

Linear-by-linear association  $p < 0,0005$

**Table 2:** Association of concentration of C reactive protein (CRP) and Erythrocyte Sedimentation Rate (ERS) with the result of CT in 176 patients.

in the diagnosis of ARS. CRP tested by near-patient testing can be read faster while the patient is in the clinic, in contrast to the ESR, which can only be read after 1 hour.

### Final Comments

In our studies we were not able to demonstrate an association to the severity of CT changes neither unilateral nor bilateral to facial pain or pressure. It is well known, that in the trigeminal nuclei both ipsi- and contralateral nerve fibers transmit impulses from the maxillary sinuses (Trigeminal areas), the majority of these, especially those close to the midline, being transmitted to the lower part of the ipsilateral trigeminal nucleus. From here the impulses traverse the midline to the opposite

cerebral cortex. Accordingly it is our belief that this might a possible explanation for the observation, but it is an interesting observation as the importance of uni- and bilateral signs and symptoms in ARS paradoxically are not confirmed to CT findings.

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