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# How does nose blowing effect the computed tomography of paranasal sinuses in chronic sinusitis?

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**Abstract**

*Objective:* Our aim was to determine whether inward or outward movement of the secretions in the paranasal sinuses due to nose blowing after nasal decongestion has any effect on the paranasal sinus computed tomography (CT) images in patients with sinusitis and to asses whether nose blowing may result in misdiagnosis or overdiagnosis in radiological evaluation of sinusitis. *Materials and methods:* Twenty-four patients with chronic sinusitis were evaluated in an academic tertiary care hospital and data were collected prospectively. After coronal sinus computed tomography scans were performed at 100 mA setting which was half the value of the standard radiation dose suggested by the manufacturer, topical decongestion was applied to each nostril followed by nose blowing 10 min later. Sinus CT scans were then repeated at the same setting. We evaluated the mucosal thickness of medial, lateral, superior and inferior maxillary and frontal sinus walls and the maximal thickness in anterior ethmoidal cells. The measurements prior to and following nose blowing were compared with Wilcoxon signed ranks test. The obtained images were also staged using Lund–McKay staging system separately and the scores were compared with Student's *t*-test. *Results:* We observed a tendency towards reduction in mucosal thickness after nose blowing. There were statistically significant differences between maxillary sinus inferior wall and frontal sinus inferior wall mucosal thickness values prior to and after nose blowing. The difference however was very small, about 0.5 mm in magnitude and Lund–McKay score did not change in any of the patients after nose blowing. *Conclusion:* Nose blowing and topical nasal decongestion does not have any effect on the diagnostic accuracy of sinus CT in chronic sinusitis patients.


*Keywords:* Paranasal sinus; Blowing; Nose; Chronic sinusitis; Computed tomography

## 1. Introduction

Computed tomography (CT) scanning of the paranasal sinuses has become the gold standard in the evaluation and surgical planning for chronic rhinosinusitis. It provides excellent anatomical soft tissue and bony detail [1,2]. It is essential in the diagnosis of sinusitis but need to be considered as part of the overall clinical picture [3]. Despite its widespread use, the sensitivity, specificity, and diagnostic accuracy of paranasal sinus CT scanning for chronic rhinosinusitis have not been rigorously assessed [1]. It is possible to misdiagnose the sinonasal disease by CT [4–6]. Factors that may adversely effect its diagnostic accuracy needs to be clarified.

Well-accepted recommendations about preparation of the patients prior to sinus CT have been published [7–9]. Phillips and Platts-Mills has recommended a patient preparation protocol in the *Journal of American Medical Association* study in which patients are scanned in a prone, direct coronal position after clearing their nose and having a decongestant agents administered nasally [7]. Zinreich et al. has used a similar protocol [9]. The majority of the studies about paranasal sinus computed tomography do not mention whether or not they have used nasal decongestion and nose clearing in preparing the patients for CT, although the aforementioned recommendations offer both of them. Only a few studies mention that nasal blowing is used in order to enhance image quality [10]. In these settings, if some studies use nose clearing while others do not, there will be an

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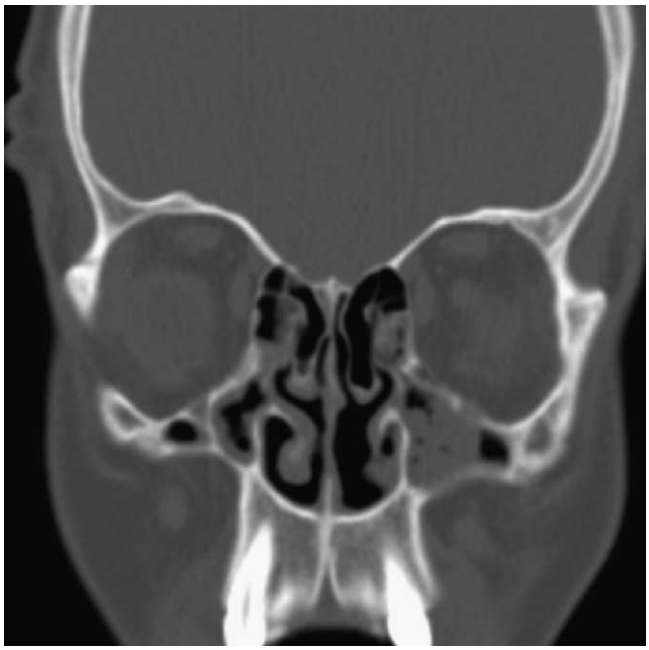

Fig. 1. Air bubble formation in right maxillary sinus.

uncontrolled parameter which may directly effect the study results. In addition even if all studies are conducted in a uniform manner, some patients may clear their noses prior to imaging as a habit for symptomatic relief and thus induce a change in sinus CT appearance. It is unclear whether these factors have an important effects on the sinus CT images which would eventually change the diagnostic accuracy of imaging and would lead to possible misdiagnosis. Thus, it is virtual to validate the stability of the CT appearance after nose blowing and to show that its diagnostic accuracy is not adversely effected.

The high intranasal pressure resulting from nose blowing may force the airflow into the sinuses through sinus ostia. Bubble formation in the maxillary sinus of adults with cold has been described previously by Gwaltney et al. They claimed that the bubbles in the sinus cavity may have been resulted from simultaneous induction of air and fluid from the nasal cavity [11]. We have encountered a similar patient with chronic sinusitis who had failed through medical treatment (Fig. 1). This patient also described that when blowing his nose he 'blows hard'. Forceful nose blowing with high pressure may propel the secretions in nasopharynx or nasal cavity into the sinus cavity during nose blowing. Alternatively, nose blowing may cause a clearing effect on sinonasal secretions with the mechanical force of the airflow filling the sinus cavity. Movement of the secretions into or out of the sinus due to nose blowing may change the radiological appearance of the sinuses and thus may have an adverse effect on the diagnostic accuracy of sinus CT. This point is especially important at the decision making step for any sinus operation where the information from the sinus CT images is used to decide whether or not to operate on a specific chronic sinusitis patient.

To test this hypotheses, sinus CT imaging prior to and after nose blowing were taken and mucosal thickness values of the sinuses prior to and after blowing were determined. To our knowledge, there are only a few studies about the effect of nose blowing on computed tomography appearance of the paranasal sinuses [11] and this is the first study about the effect of nose blowing on paranasal CT image parameters in chronic sinusitis patients.

## 2. Materials and methods

### 2.1. Patients

Eligible patients were adults with a clinical diagnosis of chronic sinusitis based on their medical history, physical examination, presence of signs and symptoms for at least 3 months and radiographic findings. All of our patients had failed through medical management.

Twenty-six (13 male, 11 female; mean age: $36.3 \pm 8.9$ years; range: 20–51 years) consecutive patients with sinusitis were included in our study, thus 48 nasal fossae were compared with statistical analysis. Patients with severe septal deviation, seasonal allergies, and nasal polyps were excluded from the study. The investigation was approved by the Local Research Ethics Committee of our institute. Verbal consent was obtained from the patient on the day before the study.

### 2.2. Technique of CT imaging

Coronal CT images were taken using a Philips Secura spiral tomography unit (Best, Holland) with 120 kV, 3 mm slice thickness and 1 s scanning time. The applied radiation dose was 100 mA which was half the value of the standard radiation dose suggested by the manufacturer. The region extending from the frontal sinus to the sphenoid sinus was scanned with the window width and levels controlled so as to allow visualization of the mucosal and osteal lesions. In all cases, sections were analyzed with Easy Vision software (version 5.1.1.2 Philips Medical Systems), which enabled us to make measurements on images.

After the initial sinus CT imaging, topical nasal decongestant (oxymetazolin HCl; Iliadin®, Merck) was applied to the subjects, in order to facilitate the removal of the nasal secretions by nose blowing, and to eliminate the effect of the nasal cycle and mucosal irregularities. After nasal decongestion the nasal conchae were found to be shrunken and almost of equal size on both sides (Fig. 2A and B). The patients were then instructed to blow their noses for three times 10 min later. After this procedure, CT images were taken again in same settings. The value of the mA was reduced to 100 mA level in order to prevent high radiation exposure in each scan. The 100 mA level, does not change the image quality prominently. Kearney et al. demonstrated that, mA values as low as 40 can be used without adversely affecting the diagnostic quality of the examination [12].