Comparison of low and high computed tomography radiation dose in sinusitis

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Abstract
Introduction
The aim of this paper was to compare the quality of CT scan images using low dose CT compared with standard dose CT in patients with suspected sinusitis.

Materials and methods
Sixty patients aged between 6 and 25 years were enrolled in this study. CT was indicated based on suspicion of sinusitis; patients were divided randomly into 2 groups. In the first group the standard CT protocol was obtained using 451 mAs in the axial projection and 503 mAs in the coronal projection. In the second group, patients were exposed to 16 mAs in the axial projection and 23 mAs in the coronal projection. Comparison of image quality was performed between the two groups based on certain parameters.

Results
Images obtained using low mAs value showed comparable image quality to standard mAs protocol in coronal projection with minimal noise. In axial projection, the low mAs protocol, image quality was optimal in 73% plotted against the standard protocol.

Conclusion
Low dose sinuses CT are as effective as high dose computed tomography in all patients with coronal projections and in 96.6% of patients in axial projection. Low dose sinus CT scan is highly recommended in the assessment of sinusitis.

Introduction
Sinusitis is considered one of the most common diseases worldwide with established evidence that it is increasing in both incidence and prevalence1.

CT has become the method of choice for diagnosis and staging of different sinus pathologies including inflammatory disease thus it is a preferred examination for the diagnosis of chronic sinusitis2–3. There has been an increase in the use of Computed Tomography (CT) as a clinical diagnostic imaging modality worldwide4, therefore radiation exposure to the public has also increased5. CT scan accounts for only 4% of all radiologic examinations and accounts for more than 40% of the total radiation dose in United Kingdom6.

Sinusitis is a commonly encountered entity in general practice7, although radiography is not routinely indicated in these patients. Sinuses CT scan is widely performed in the imaging workup of sinusitis, as it has a high sensitivity but is also criticized for the lack of specificity. Mucosal thickening of the paranasal sinuses can be seen in up to 30% of the asymptomatic population8. In addition, mucosal thickening of sinuses has been reported in patients with nonspecific upper respiratory tract viral infection, such as the common cold9, the radiation doses from CT are relatively high and often can approach or exceed the levels known to increase the probability of cancer10.

The aim of this study was to evaluate the effect of lowering the CT scan dose of the sinuses to as low as reasonably achievable (ALARA) dose that is comparable to the effective dose of a radiographic examination on images quality.

Materials and methods
This work conforms to the values laid down in the Declaration of Helsinki (1964). The protocol of this study has been approved by the relevant ethical committee related to our institution in which it was performed. All subjects gave full informed consent to participate in this study.

From Jan 2009 to Jan 2010, sixty consecutive patients aged between 6 and 25 years were prospectively reviewed at King Hussein Medical Centre of Jordan (KHMC), all patients were suggested to have sinusitis and CT was indicated to support the final diagnosis, patients were divided randomly into 2 groups; the first one was exposed to the standard parameters of radiation (451 mAs in the axial projection and 503 mAs in the coronal projection).

In the second group, CT scan was performed with mAs values of 16 in the axial projection and 23 in the coronal projection. Parameters for assessment of image quality were the ability to define the ostiomeatal complex in the coronal projection and to distinguish the margins of air, soft tissue and bone in both axial and coronal projection. The images were blindly evaluated by two diagnostic radiologists.

Results
Sixty consecutive patients were prospectively reviewed and randomly divided into 2 groups, the first group was composed of 30 patients aged between 7 and 25 years (average 15.2 years), 16 of them were males, the patients of this group were exposed to standard dose of radiation parameters (451 mAs in the axial projection and 503 mAs in the coronal projection). In this group all images showed well defined ostiomeatal complex in the coronal projection and easily distinguishable air-soft tissue interface and bone margins in both axial and coronal projection with minimal noise (Figure 1). In the second group, 30 patients aged between 6 and 25 years...
The use of low radiation dose in sinus images has been the target of health care providers since the early days of CT scan imaging. This policy of radiation reduction was also suggested before for other parts of the body such as the head, chest, and abdomen. In our study, we found that there were no statistical differences between the two groups regarding age or gender. It was clearly noted that low dose CT images obtained in coronal projection were as effective as the high dose CT regarding the definition of osteomeatal complexes, distinguishing air-soft tissue interfaces and bone margins and regarding the presence of noise. In the axial projections; low dose CT images obtained continued to be as effective as the high dose CT in 73.3%. It is worth mentioning that all of them were between 6 and 16 year of age. 23.3% of patients had more noise at axial projection; however air soft tissue and bone margins still can be distinguished. Low dose CT is effective as high dose CT where the concern about documentation of the presence of soft tissue rather than its differentiation. This exactly what was found by Naldich et al. who studied the effect of low dose chest CT in the assessment of lung lesions.

**Conclusion**

Low dose sinus CT is effective as high dose CT in all patients with coronal projections and in 96.6% of patients in axial projection and so low dose sinus CT is highly recommended for the radiological assessment of sinusitis especially in children.

**References**


**Table 1: Summary of two study groups (standard and low dose radiation)**

<table>
<thead>
<tr>
<th></th>
<th>Group I</th>
<th>Group II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Age</td>
<td>6-25 (Avg 15.6) yrs</td>
<td>7-25 (Avg 15.2) yrs</td>
</tr>
<tr>
<td>CT mAs</td>
<td>451 mAs for Axial, 503 mAs for coronal</td>
<td>16 mAs for Axial, 23 mAs for coronal</td>
</tr>
<tr>
<td>Axial low mAs Vs standard mAs</td>
<td>Satisfactory readability in 73.3%, excessive noise in 23.3%</td>
<td></td>
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<tr>
<td>Coronal low mAs Vs standard mAs</td>
<td>Satisfactory readability in 100% of cases</td>
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**Conflicts of interest:** None declared.

**Research study**

All authors contributed to conception and design, manuscript preparation, read and approved the final manuscript. All authors abide by the Association for Medical Ethics (AME) ethical rules of disclosure.

Competing interests: None declared. Conflict of interests: None declared.
All authors contributed to conception and design, manuscript preparation, read and approved the final manuscript. All authors abide by the Association for Medical Ethics (AME) ethical rules of disclosure.