Maxillary Sinus Findings in the Elderly:  
A Panoramic Radiographic Study

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Abstract

Aim: The aim of the present study was to investigate the prevalence of maxillary sinus findings in elderly subjects above the age of 50 through the use of panoramic radiography and to test the hypothesis that such findings are more prevalent in dentate subjects.

Methods and Materials: A total of 105 subjects over the age of 50 years were examined both clinically and radiographically in the Department of Oral Medicine and Radiology of the Manipal College of Dental Sciences in Manipal, India, over a period of three months for various reasons. Eight were excluded due to the lack of diagnostic quality of their radiographs. The manually calculated kappa test was used to determine the statistical significance of intra-examiner reliability. The other data were analyzed using a manually calculated z-test for proportions where z ≥1.96 or p<0.05 were considered statistically significant.

Results: The prevalence of radiographic maxillary sinus findings in 97 elderly subjects (aged above 50 years) were investigated with the use of panoramic radiography. Fifty subjects had at least one natural tooth radiographically in the upper jaw and 39 subjects were radiographically edentulous in the upper jaw. Mucous cysts or diffused mucosal thickenings were found in 42.26% of the subjects. Of the mucosal thickenings, 74.35% were found in subjects with a dentate upper jaw (p<0.05). The prevalence of a mucous cyst was 2.06% in subjects with a dentate upper jaw and a finding of no mucous cysts in edentulous subjects suggests an odontogenic cause.

Conclusions: According to the findings of the present study, the presence of mucosal thickening or mucosal cysts may be due to the presence of irritative stimuli, often an infection of dental origin, as these findings are more prevalent in dentulous subjects.

Clinical Significance: The panoramic radiograph is an excellent diagnostic tool for the identification of mucosal thickening and mucosal cysts. The accurate diagnosis of infective foci (chronic apical periodontitis, deep pockets caused by periodontitis) is necessary, because in conditions of decreased host resistance it may lead to acute sinusitis.
Polyps usually seen in allergic conditions are formed when fluid accumulates in the loose connective tissue. A mucocele is a large bone-destroying cyst that occurs as a result of a blocked ostium and is rare in the maxillary sinus. Mucous cysts and other mucosal thickenings usually cause no symptoms, but occasionally may be related to facial pain, headache, and toothache.

Mucous cysts tend to rupture and mucosal thickening resolves after the cause is removed. Radiographically the retention cyst appears as a well-defined “dome-shaped” uniform radiopacity with a rounded outline arising from the floor of the sinus.

Most retention cysts of the maxillary sinus spontaneously regress or show no significant change in size over the long term. These findings suggest, in the absence of associated complications, “wait and see” may be the appropriate management strategy for retention cysts.

Odontogenic cysts may also encroach on the maxillary sinus, but they have a thin radiopaque bony margin that is absent in mucous cysts. A mucosal thickening appears as a diffuse, often polyposic radiopacity along the margin of the sinus without a well-defined rounded outline. The diffuse mucosal thickening and mucous cysts are most common in maxillary sinus with frequencies up to 50% of the incidental radiographic findings.

Periodontal and periapical infection also may cause mucosal swelling or sinusitis. Odontogenic sinusitis represents between 5 and 45% of all sinusitis cases. The roof of the maxillary sinus is not clearly imaged in a normal panoramic projection, but the floor is clearly visible. However, mucous cysts

Keywords: Maxillary sinus, mucous cyst, diffuse mucosal thickening, panoramic radiography.


Introduction

The maxillary sinus begins to develop in utero at about three months. It is about the size of a pea at birth and increases in size to adulthood. It is the largest of the paranasal sinuses. Ohba & Katayama found panoramic views to be superior to the Water’s projection in detecting cyst-like densities in the maxillary sinus, whereas the Water’s view was better for demonstrating cloudiness of the maxillary sinus and sclerotic changes in the adjacent bony structures.

The maxillary sinus has a close proximity to the orbit, alveolar ridge, and maxillary teeth and shares its nerve supply with these structures. The floor of the sinus in an adult is around 1 to 1.25 cm below the level of the floor of the nasal cavity. The significance of this floor is related to its relationship to the roots of the maxillary teeth and the alveolar process. The bony floor may be dehisced completely above the apices of the roots, bringing the periapical tissues into direct contact with the membranous lining of the sinus. Such a close relationship between the sinus and the teeth may facilitate the spread of pathologic conditions of dental origin into the sinus. Maxillary premolars and molars are most consistently situated below the floor of the sinus. The root apices of the second molar are in the closest proximity to the sinus floor, followed by the first molar, the third molar, the second premolar, then the first premolar and canine.

The maxillary sinus mucosa responds to oscillating stimuli by swelling from its normal 1 mm thickness to 10–15 mm. If a duct of a seromucinous gland is blocked during the inflammatory period, the secretion dilates the gland and the duct, forming a cyst lined with epithelium. This is the secretory type of mucous cyst, also called a retention cyst.

Polyps usually seen in allergic conditions are formed when fluid accumulates in the loose connective tissue. A mucocele is a large bone-destroying cyst that occurs as a result of a blocked ostium and is rare in the maxillary sinus. Mucous cysts and other mucosal thickenings usually cause no symptoms, but occasionally may be related to facial pain, headache, and toothache. Mucous cysts tend to rupture and mucosal thickening resolves after the cause is removed.

Radiographically the retention cyst appears as a well-defined “dome-shaped” uniform radiopacity with a rounded outline arising from the floor of the sinus. Most retention cysts of the maxillary sinus spontaneously regress or show no significant change in size over the long term. These findings suggest, in the absence of associated complications, “wait and see” may be the appropriate management strategy for retention cysts.

Odontogenic cysts may also encroach on the maxillary sinus, but they have a thin radiopaque bony margin that is absent in mucous cysts. A mucosal thickening appears as a diffuse, often polyposic radiopacity along the margin of the sinus without a well-defined rounded outline. The diffuse mucosal thickening and mucous cysts are most common in maxillary sinus with frequencies up to 50% of the incidental radiographic findings.

Periodontal and periapical infection also may cause mucosal swelling or sinusitis. Odontogenic sinusitis represents between 5 and 45% of all sinusitis cases. The roof of the maxillary sinus is not clearly imaged in a normal panoramic projection, but the floor is clearly visible. However, mucous cysts
and other mucosal thickenings are usually well demonstrated, as they almost always arise from the antral floor. Few studies have so far been carried out to assess the prevalence of maxillary sinus findings in the elderly. 8

The aim of the present study was to determine the prevalence of maxillary sinus findings in elderly subjects above the age of 50 using panoramic radiography, and to test the hypothesis that such findings are more prevalent in dentate subjects.

Methods and Materials

A total of 97 subjects over the age of 50 years were selected from a pool of 105 patients for this study. Eight subjects were excluded due to the lack of diagnostic quality of their radiographs. Subjects were individuals who were examined both clinically and radiographically for various purposes during a period of three months in the Department of Oral Medicine and Radiology of the Manipal College of Dental Sciences in Manipal, India (Table 1).

A medical history was taken to determine if any allergy or chronic sinusitis and medical problems existed prior to the clinical examination. Subjects with a history of any allergy or chronic sinusitis were excluded from the study. A panoramic radiograph was taken of each patient using a PM 2002 CC panoramic X-ray machine (Planmeca, Helsinki, Finland) in the standard manner using Kodak medium-speed panoramic film (Kodak, Inc., Rochester, NY, USA).

All films were processed in a Promax™ automatic processor (Promax, Chayagraphics, Bangalore, India). Radiographs were studied by a dental radiologist under standard conditions and maxillary sinus findings recorded. In two cases, intraoral periapical radiographs were taken using a Confident C-41 X-ray machine (Confident Dental Equipment Ltd., New Delhi, India) and Kodak E speed intraoral film (Kodak, Inc., Rochester, NY, USA) whenever any doubt existed regarding the presence of a mucosal finding. Panoramic radiographs of poor diagnostic quality in which the floor of the maxillary sinus could not be evaluated diagnostically were excluded from the study.

Findings of increased radiopacity in the sinus floor were recorded as follows:

1. Well-defined radiopacity with a rounded (convex) outline arising from the floor or walls of the sinus was categorized as a mucous cyst.
2. Diffuse band-like radiopacity along the margins of the sinus without well-defined outline was categorized as a mucosal thickening (MT).

A total of 15 randomly selected (8 edentulous, 7 dentulous) panoramic radiographs were viewed after a gap of three months to assess the intra-examiner variability using the manually calculated kappa test to determine the statistical significance of the intra-examiner reliability. The other data were analyzed using manually calculated $z$-test for proportions where $z \geq 1.96$ or $p<0.05$ was considered statistically significant.

Results

With regard to the status of the dentition, 55 subjects (22 males and 33 females) had clinically visible natural teeth while 42 subjects (20 males and 22 females) were clinically edentulous. Among the subjects 58 had at least one radiographically visible natural tooth or root in the upper jaw while 39 subjects were radiographically edentulous in the upper jaw. The age and sex distribution of the maxillary sinus findings is summarized in Tables 2 and 3. Intra-examiner agreement between two rounds of viewings was 100%.

Of the 97 patients, 39 (40.20%) had mucosal thickenings and two patients (2.06%) had mucous cysts. In the present study, the prevalence of maxillary sinus findings appeared to be greater in males (47%) than females (38.18%) ($p<0.05$).

Out of 58 subjects who had at least one radiographically visible natural tooth in their upper jaw, 31 subjects (53.44%) had radiopaque findings in their maxillary sinus: 2 (3.44%) subjects had...
Table 2. Maxillary sinus finding (n) according to age.

<table>
<thead>
<tr>
<th>Age in Years</th>
<th>50–60</th>
<th>61–70</th>
<th>71–80</th>
<th>Total</th>
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<tbody>
<tr>
<td>No.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>33</td>
<td>18</td>
<td>5</td>
<td>56</td>
</tr>
<tr>
<td>Mucous cyst</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>DMT</td>
<td>22</td>
<td>13</td>
<td>4</td>
<td>39</td>
</tr>
<tr>
<td>Total</td>
<td>56</td>
<td>32</td>
<td>100</td>
<td>97</td>
</tr>
</tbody>
</table>

Table 3. Maxillary sinus findings according to sex.

<table>
<thead>
<tr>
<th></th>
<th>Women</th>
<th>Men</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Normal</td>
<td>34</td>
<td>22</td>
<td>56</td>
</tr>
<tr>
<td>Mucous cyst</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>DMT</td>
<td>21</td>
<td>18</td>
<td>39</td>
</tr>
<tr>
<td>Total</td>
<td>55</td>
<td>42</td>
<td>97</td>
</tr>
</tbody>
</table>

Table 4. Maxillary sinus findings in subjects with an edentulous or a dentulous maxilla.

<table>
<thead>
<tr>
<th></th>
<th>Edentulous</th>
<th>Dentulous</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Normal</td>
<td>29</td>
<td>27</td>
<td>56</td>
</tr>
<tr>
<td>Mucous cyst</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>DMT</td>
<td>10</td>
<td>29</td>
<td>39</td>
</tr>
<tr>
<td>Total</td>
<td>39</td>
<td>58</td>
<td>97</td>
</tr>
</tbody>
</table>

Figure 1. Orthopantomographic view showing mucosal thickening in the floor of the right maxillary sinus.

Figure 2. Orthopantomographic view showing mucous cyst in the floor of the left maxillary sinus.
mucous cysts and 29 (50%) subjects had mucosal thickenings, as shown in Table 4.

Out of the 39 subjects with mucosal thickenings (Figure 1), 29 were patients with at least one radiographically visible tooth or root in the upper jaw (dentulous maxilla) as shown in Table 4 (p<0.05).

The prevalence of mucous cysts (Figure 2) was 3.44% in subjects with a dentulous maxilla. No mucous cysts were found in patients with edentulous maxilla. No destructive mucocele was found in any of our subjects.

Discussion

The prevalence of mucosal thickening and mucous cysts in the maxillary sinuses in the present study showed a prevalence of 12.36%.

The prevalence of mucous cysts in maxillary sinus ranges from 2–13%8,9,10 and in the present study it was 2.06%, which is near the lower limit. Myall, Eastep, and Silver11 observed 1,469 orthopantomographs where 5.1% showed mucous cysts and the occurrence was twice as frequent in men as in women. According to Mattila12 the prevalence of mucous cysts is not age dependent and is most prevalent among men.

The prevalence of mucosal thickening in all paranasal sinuses together has been up to 50% in facial radiographs taken for purposes other than suspected sinus disease.13

The prevalence of mucosal thickening was found to be greater in younger subjects who had more teeth14 and the majority of both mucous cyst and mucosal thickening were found in dentate subjects.8,15,16 These findings are in agreement with the observations in the present study in which 31 out of 41 (75.5%) of mucosal thickening and mucous cysts were found in subjects with a dentulous maxilla. Thus, it can be concluded the 29 out of 41 (70.7%) mucosal thickenings present in a dentulous maxilla may be a consequence of odontogenic infection. Also the mucous cysts were present only in dentulous subjects. Halstead8 conducted a study on 75 patients and concluded that odontogenic causes could be considered in 90.4% of patients with mucous cysts. In the present study mucosal thickening and mucous cysts in subjects with an edentulous maxilla were found in 10 out of 41 (24.4%) subjects.

Even though a higher prevalence of maxillary findings was observed in the present study, no history of allergy or chronic sinusitis was reported by the subjects. In most cases, the maxillary posterior teeth were present and there were either caries with periapical changes, root stumps, periodontal problems, or deep/large restorations present. These odontogenic factors can lead to mucosal thickening or formation of mucosal cysts on the floor of the maxillary sinus.

Conclusions

According to the findings of this study, the presence of mucosal thickening or mucosal cysts may be due to the presence of irritative stimuli, often an infection of dental origin as these findings are more prevalent in dentulous subjects. The accurate diagnosis of infective foci (chronic apical periodontitis, deep pockets caused by periodontitis) is necessary because in conditions of decreased host resistance it may lead to acute sinusitis.

Clinical Significance

The panoramic radiograph is an excellent diagnostic tool for the identification of mucosal thickening and mucosal cysts. The accurate diagnosis of infective foci (chronic apical periodontitis, deep pockets caused by periodontitis) is necessary because in conditions of decreased host resistance it may lead to acute sinusitis.
References


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