Systematic Review

Case analysis and systematic review of aspergilloma

Georgia Benitha J.*, Prathiba Ramani, Reshma Poothakulath Krishnan, Gheena S., Abhilasha R.

Department of Oral and Maxillofacial Pathology, Saveetha Dental College and Hospitals, Chennai, Tamil Nadu, India

Received: 21 May 2021
Accepted: 07 July 2021

*Correspondence:
Dr. Georgia Benitha J.,
E-mail: 152007004.sdc@saveetha.com

ABSTRACT

Among various fungal pathogens, Aspergillus fumigatus is the most prevalent human pathogen reported to cause human disease such as aspergilloma or aspergillosis. Aspergillomas are commonly seen in a poorly drained and avascular cavitary space which evokes an inflammatory reaction. Most commonly involving paranasal sinuses especially maxillary sinus. For the past 2 decades incidence of aspergillosis has increased substantially. The main objective of this systematic review was to evaluate the cases reported to be aspergilloma of maxillary sinus and to determine the percentage of cases involving aspergilloma of maxillary sinus in healthy individuals. After the final full text review, 16 articles were included in this systematic review. Data were extracted from the full text articles and reviewed and extracted content. About 83% had a history of dental procedures, with 42% of those being due to infection from previous extraction sockets and 41% due to RCT. About 43% of the patients in this study were immunocompromised, while 56% were healthy and had no known predisposing conditions. The aspergillus fungal infections affecting the paranasal sinuses are common which can affect apparently healthy as well as immunocompromised individuals. Aspergilloma is the most common fungal infection involving maxillary sinus with iatrogenic dentogenic factors being the most predominant factor for the initiation and progression of aspergillus fungal infection. About 43% of the patients in this review were immunocompromised patients whereas 56% of the patients were healthy without any known predisposing conditions. The progression and prognosis of these diseases depends on the location and immunologic status of the patient. So, it is very important for the dentists to be more cautious while performing any dental procedures so as not to initiate any iatrogenic infections.

Keywords: Aspergilloma, Case report, Aspergillosis, Mycetoma, Maxillary sinus, Odontogenic infection, Dental treatment

INTRODUCTION

The opportunistic fungal infections of the oral cavity are most commonly caused by Candida species. The second commonest is the A. fumigatus species. A. fumigatus which belong to ascomycetes class of saprophytic fungi that are normally avirulent in healthy individuals but are capable of causing infections in immunologically competent as well as compromised individuals. Hence they are truly opportunistic pathogenic fungi and also one of the most common widespread airborne saprophytic fungi causing infection. Its spores, conidia are found in the environment and once the organism gains entry into the respiratory tract, it spreads by its hyphael form and releases toxins. When the conidia is restricted within the lungs for a longer period of time, it gradually causes infection and also, these species are capable of disseminating to various sites through blood and endothelial lining by releasing their toxins. A. fumigatus are responsible for releasing various toxins such as haemolysin, aflatoxin, gliotoxin and phthalic acid. A. fumigatus is solely responsible for causing sinus
aspergillosis. Aspergilloma is a subtype of aspergillosis, commonly referred to as fungus ball or mycetoma. Deve in 1938 was the first person to describe an aspergilloma and named it as mycetoma. Belcher and Plummer formulated the classification of aspergilloma in 1960 as simple aspergilloma and complex aspergilloma. Aspergilloma appears as a large, expansile mass, without involvement of the underlying mucous membrane. It is commonly appreciated in the body cavities such as lungs, paranasal sinuses, especially the maxillary sinus antrum with palatal perforations more common in oral considerations. The main predisposing factors for development of aspergilloma are preexisting pulmonary disorders, chronic debilitating conditions and immunosuppression. It is usually asymptomatic and may take several years for the symptoms to occur. Even though it is asymptomatic in majority of the cases, hemoptysis is the most common clinical manifestation in symptomatic patients. Aspergilloma mainly affects individuals with pre-existing lung disorders such as tuberculosis, sarcoidosis, bronchiectasis, cystic fibrosis and systemic immunodeficiency. The global prevalence of aspergilloma over a period of 5 years is estimated to be 18/100000.

The main objective of this paper was to discuss the etiology and management of odontogenic maxillary sinus aspergilloma as well as to present new case and review previously published cases. A systematic search of the literature on maxillary sinus aspergilloma of odontogenic origin on PubMed/Medline and Google Scholar was conducted for this purpose all through 2017. The keywords: aspergillosis, aspergillus, aspergilloma, fungus ball, mycetoma, maxillary sinus, odontogenic and dental as well as combinations thereof were used in the search.

Clinical presentation

A 25 years male reported to Saveetha dental college and hospitals with a complaint of pain in his left maxillary region, which was mild and localized with presence of notable nasal discharge for the past 10 months. The nasal discharge was thick, yellowish in colour and was appreciated for every 10-15 minutes. Also 2 years earlier, the patient met with an accident and has undergone an orthognathic surgery (anterior maxillary osteotomy and bilateral sagittal split osteotomy) with fixation of miniplates and screws. Patient was not under any medicines and no history indicative of immune-deficiency. The family and occupational histories did not
reveal any significant findings and there were no known drug allergies. On examination and palpation, the maximum size of the lesion was that of the entire maxillary sinus and also, the patient experienced tenderness extending from the philtrum of lip up to the left zygoma. Extraoral and intraoral examination revealed no evident swelling. On radiographic examination, the OPG shows radiopaque haziness in the entire left maxillary antrum. Further CT scan showed hyperdense area with breaching of cortical bone involving the anterolateral wall of the left maxillary sinus (Figure 1). The patient has undergone debridement and sinus exploration in left maxillary sinus along with removal of miniplates and screws to prevent further possible infections. After surgery, the samples were sent to the department of oral and maxillofacial pathology. The histopathological examination of resected specimen was performed via hematoxylin and eosin stained sections. The section showed fungal hyphae in several areas were densely packed giving an appearance of a mass/ball which was suggestive of fungal infection-aspergilloma (Figure 2). There was hypertrophic pseudostratified ciliated columnar epithelium and the underlying dense connective tissue stroma showed abundant filamentous tightly packed septate hyphae branching at 45 degree acute angles within inflammatory exudates and cell debris. Routine blood investigations showed normal levels. According to the patient’s history and clinical study, the patient was prescribed analgesics and antibiotics. A 1 year follow up was done until the patient became asymptomatic.

METHODS

Search strategy for identification of studies

In this systematic review of case reports of aspergilloma or aspergillosis the search strategy was in accordance with the Cochrane guidelines for systematic reviews.11 The case reports included in this study were extracted from PubMed and back references of the articles till the year 2010. The internet search was also done to obtain relevant case reports of our interest. The case reports which presented aspergilloma or aspergillosis in maxillary sinus cavities were included in this study. The titles and the abstracts were reviewed. The text of the selected case reports was retrieved and further analyzed.

Search methodology

The search methodology applied in PubMed was using the following keywords: aspergilloma or aspergillosis and maxillary sinus or maxillary antrum and case report filters in the last 10 years.

Selection of studies

Inclusion criteria

Case reports with aspergilloma or aspergillosis reported in the maxillary sinus, case reports published in English language and case reports published in the last 10 years (2010-2020) were included.

Exclusion criteria

Case reports published in other languages and case reports with aspergilloma and aspergillosis reported other than maxillary sinus was excluded.

RESULTS

Methods of review

The initial search yielded 31 results. Additional filters were added for restraining the search to last 10 years (2010-2020), yielding 20 results. 14 articles were excluded based on the exclusion criteria, title and abstract screening reviews. 6 articles were approved for full text review from PubMed search and an additional of 10 articles was included from Google search, manual search and cross references. After the final full text review, 16 articles were included in this systematic review. Data were extracted from the full text articles and reviewed and extracted content. Figure 4 presents the search flowchart.

The accuracy of the primary data extracted from each study was independently verified. Collected data consisted of the following: patient age, sex, site, medical history, radiographic findings, treatment done and follow up from studies performed from 2010-2020 (Table 1). The study population included, we found that about 60% of aspergilloma or aspergillosis cases occurrence was seen in male patients, when compared to 40% cases found in female cases and mean (SD) age of the patients was 40.9 years. 12% of the cases in this review reported to have bilateral maxillary sinus aspergilloma, else all cases had been reported with 88% reported involving unilateral maxillary sinus with left maxillary more common when compared to right. About 83% of the cases showing previous history of dental procedures, in that 42% was due to infection caused by previous extraction sockets and 41% was due to undergoing RCT. About 43% of the patients in this review were immune-compromised patients whereas 56% of the patients were healthy without any known predisposing conditions. In all the included studies, the standard treatment followed was Caldwell Lauc procedures followed by antifungal therapy. All the reported cases have shown complete recovery within a time period of 3-12 months of follow up.
Table 1: Summary of previous case reports of aspergilloma or aspergillosis in maxillary sinus in the last 10 years.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Title</th>
<th>Author</th>
<th>Year</th>
<th>Country</th>
<th>Age/sex</th>
<th>Site</th>
<th>Medical history</th>
<th>Clinical findings</th>
<th>Radiographic findings</th>
<th>Treatment done</th>
<th>Follow up</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>A case report of maxillary aspergillosis with unusual clinical and imaging presentation¹²</td>
<td>Jan et al</td>
<td>2020</td>
<td>Saudi Arabia</td>
<td>39 years/ male</td>
<td>Left maxillary sinus region</td>
<td>Not available</td>
<td>Pain in left posterior maxillary sinus, defective restoration in relation to 27 with tender on percussion in relation to 27 and 25; swelling seen in vestibular buccal mucosa</td>
<td>Panoramic image shows loss of cortical boundaries of the left maxillary sinus. CBCT shows mucosal thickening in both sinuses pronounced in the left maxillary sinus. Well defined soft lesion showing bowing and discontinuous</td>
<td>Surgical debridement with antibiotics (oral amoxicillin 500 mg three times daily, ibuprofen 600 mg 4 times daily and a chlorhexidine mouth rinse for a week)</td>
<td>1 year</td>
</tr>
<tr>
<td>2.</td>
<td>Maxillary sinus aspergillosis associated tooth root piece: a case report</td>
<td>Rani et al</td>
<td>2016</td>
<td>New Delhi</td>
<td>42 years/ female</td>
<td>Left maxillary sinus region</td>
<td>Non-immunocompromised</td>
<td>Pain in relation to the left upper jaw with tenderness in maxillary sinus; intraorally healed tooth socket in relation to 25</td>
<td>PNS view shows slight opacity in the left maxillary sinus; CT scan shows a break in the continuity of the left maxillary sinus floor in the premolar region; radiopacity in the alveolar region suggestive of tooth root piece</td>
<td>Surgical debridement with antifungal therapy (itraconazole 100 mg twice daily for 2 months)</td>
<td>6 months</td>
</tr>
<tr>
<td>3.</td>
<td>Invasive maxillary sinus aspergillosis: a case report successfully treated voriconazole</td>
<td>Beatriz et al</td>
<td>2014</td>
<td>Spain</td>
<td>81 years/ female</td>
<td>Left maxillary sinus region</td>
<td>Non-immunocompromised</td>
<td>Pain in the left maxillary sinus region, with previous history of tooth extraction in relation to 22</td>
<td>Panoramic view shows opacification of maxillary sinus; CT scan shows opacification with bone destruction of the</td>
<td>Caldwell-Luc procedure</td>
<td>4 months</td>
</tr>
</tbody>
</table>

Continued.
<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Title</th>
<th>Author</th>
<th>Year</th>
<th>Country</th>
<th>Age/sex</th>
<th>Site</th>
<th>Medical history</th>
<th>Clinical findings</th>
<th>Radiographic findings</th>
<th>Treatment done</th>
<th>Follow up</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.</td>
<td>Aspergilloma of the maxillary sinus: a case report</td>
<td>Hasanov et al</td>
<td>2014</td>
<td>Azerbaijan</td>
<td>29 years/ not available</td>
<td>Not available</td>
<td>Non-immunocompromised</td>
<td>Complaining about nasal discharge for 2 years.</td>
<td>Radiopaque mass in sinus similar to foreign body</td>
<td>Curettage of maxillary sinus</td>
<td>Not available</td>
</tr>
<tr>
<td>5.</td>
<td>Invasive sino-orbital-sklull base aspergillosis progressing from lung ball aspergil of maxillary sinus: a case report</td>
<td>Huang et al</td>
<td>2017</td>
<td>China</td>
<td>62 years/male</td>
<td>Right maxillary sinus region</td>
<td>Immunocompromised</td>
<td>Forehead pain, temporal pain, dropping of lid, loss of vision</td>
<td>Computed tomography (CT) and magnetic resonance imaging showed an invasive inflammatory or malignant process of sinus orbital skull base</td>
<td>Endonasal sinus debridement with decompression of the orbit</td>
<td>6 months</td>
</tr>
<tr>
<td>6.</td>
<td>Maxillary sinus aspergilloma of odontogenic origin: report of 2 cases with cone-beam computed tomographic findings and review of the literature</td>
<td>Torul et al</td>
<td>2018</td>
<td>Turkey</td>
<td>54 years/female</td>
<td>Left maxillary sinus region</td>
<td>Not available</td>
<td>A nasal obstruction that occurred after root canal treatment of the left maxillary first molar tooth several years previously</td>
<td>Panoramic radiograph: radiopaque mass in the left maxillary sinus; CBCT shows iron like opacity in the central area of the left maxillary sinus</td>
<td>Caldwell-Luc procedure done.</td>
<td>1 year</td>
</tr>
<tr>
<td>7.</td>
<td>Maxillary sinus aspergilloma of odontogenic origin: report of 2 cases with cone-</td>
<td>Torul et al</td>
<td>2018</td>
<td>Turkey</td>
<td>41 years/female</td>
<td>Left maxillary sinus region</td>
<td>Immunocompromised</td>
<td>Left sided pain in upper face. undergone extraction of 13 with RCT left first premolar and second molar</td>
<td>Panoramic image: radiopaque mass in the left maxillary sinus region; CBCT image: a piece of the root of the</td>
<td>Caldwell-Luc procedure done.</td>
<td>1 year</td>
</tr>
</tbody>
</table>

Continued.
<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Title</th>
<th>Author</th>
<th>Year</th>
<th>Country</th>
<th>Age/sex</th>
<th>Site</th>
<th>Medical history</th>
<th>Clinical findings</th>
<th>Radiographic findings</th>
<th>Treatment done</th>
<th>Follow up</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.</td>
<td>Unusual case of bilateral maxillary fungus ball</td>
<td>Vinciguerra et al</td>
<td>2016</td>
<td>Italy</td>
<td>34 years/ male</td>
<td>Bilateral maxillary sinus</td>
<td>Not available</td>
<td>Underwent RCT in 15, 16, 25, 26</td>
<td>OPG: iron like opacity involved bilaterally</td>
<td>CT scan: a iron like opacity, seen bilaterally within both maxillary sinus addition to this ethmoid sinus were partially involved</td>
<td>1 year</td>
</tr>
<tr>
<td>9.</td>
<td>Maxillary sinus aspergillosis: a case report of the timely failure to treatment</td>
<td>Beyk et al</td>
<td>2018</td>
<td>Iran</td>
<td>58 years/ male</td>
<td>Right maxillary sinus</td>
<td>Immunosuppressed (diabetes mellitus type 2 without nephropathy)</td>
<td>Complete headache and eye pain beginning 10 hours after extraction of 3rd molar, swelling and inflammation seen on the right side of the face</td>
<td>Not available</td>
<td>Surgical debridement done with antifungal therapy given</td>
<td>Not available</td>
</tr>
<tr>
<td>10.</td>
<td>Post endodontic aspergillosis in an immunocompetent individual</td>
<td>Urs et al</td>
<td>2015</td>
<td>New Delhi</td>
<td>35 years/ female</td>
<td>Left maxillary sinus region</td>
<td>Not available</td>
<td>Diffuse swelling and dull ache involving the left side of the face. underwent extraction of rc treated tooth before a week, a small tooth piece was accidentally broken and pushed inside the sinus</td>
<td>PNS: haziness in the lower two third of the maxillary sinus; CECT: mucosal thickening in the left maxillary sinus, radios opaque mass in relation to 25; irregular bony margins and</td>
<td>Surgical debridement done with antifungal therapy given</td>
<td>3 months</td>
</tr>
<tr>
<td>Sr. No.</td>
<td>Title</td>
<td>Author</td>
<td>Year</td>
<td>Country</td>
<td>Age/sex</td>
<td>Site</td>
<td>Medical history</td>
<td>Clinical findings</td>
<td>Radiographic findings</td>
<td>Treatment done</td>
<td>Follow up</td>
</tr>
<tr>
<td>--------</td>
<td>----------------------------------------------------------------------</td>
<td>-------------------------</td>
<td>------</td>
<td>---------</td>
<td>---------</td>
<td>-------------------------------</td>
<td>----------------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>----------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>11.</td>
<td>Aspergillosis of the maxillary sinus: review and case report&lt;sup&gt;20&lt;/sup&gt;</td>
<td>Rosa et al</td>
<td>2012</td>
<td>Not available</td>
<td>30 years/ female</td>
<td>Left maxillary sinus region</td>
<td>Non immunocompromised</td>
<td>Recurrent swelling and nasal discharge, purulent discharge seen from the sinus fistula between buccal roots of first and second molar; underwent root canal therapy few years previously</td>
<td>Water’s view: radiopaque view lying within a completely clouded left maxillary antrum; PNS view: second radiopaque view near floor of the left antrum</td>
<td>Caldwell-Luc procedure done</td>
<td>1 year</td>
</tr>
<tr>
<td>12.</td>
<td>Invasive aspergillosis associated with a foreign body&lt;sup&gt;20&lt;/sup&gt;</td>
<td>Syed et al</td>
<td>2015</td>
<td>Telangana</td>
<td>51 years/ male</td>
<td>Bilaterally involved maxillary sinuses</td>
<td>Immunocompromised (diabetes for past 10 years, chronic smoker for the past 20 years)</td>
<td>Acute pain from the upper left central incisor region, extraoral examination, a diffuse swelling was found on the left and right malar region, intraorally, the palatal gingiva showed a yellow ulcerated area (3x1 cm) in the anterior hard palate and many blackish areas near the soft palate region</td>
<td>CT scan images: thickening of mucosa and opacification of the sinuses</td>
<td>Maxillectomy done with surgical debridement of sinuses done; antifungal therapy started with intravenous liposomal amphotericin B (3 mg/kg/day for 5 weeks).</td>
<td>After one month postoperatively, provided with an obturator</td>
</tr>
<tr>
<td>13.</td>
<td>Chronic invasive aspergillus sinusitis affecting the maxillary sinus: a case report&lt;sup&gt;21&lt;/sup&gt;</td>
<td>Elkabla et al</td>
<td>2016</td>
<td>Egypt</td>
<td>30 years/ male</td>
<td>Right maxillary sinus region</td>
<td>Non-immunocompromised</td>
<td>Swelling on the right side of the cheek, dull pain, facial asymmetry and right nasal side obstruction; intraorally swelling was seen apical to right maxillary</td>
<td>OPG: radiopacity in right maxillary sinus, displaced maxillary right first and second premolars anterior extension of the lesion to the left</td>
<td>Caldwell-Luc procedure done.</td>
<td>1 year</td>
</tr>
</tbody>
</table>

Continued.
<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Title</th>
<th>Author</th>
<th>Year</th>
<th>Country</th>
<th>Age/sex</th>
<th>Site</th>
<th>Medical history</th>
<th>Clinical findings</th>
<th>Radiographic findings</th>
<th>Treatment done</th>
<th>Follow up</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>Chronic invasive aspergillosis of paranasal sinuses: a case report with review of literature&lt;sup&gt;22&lt;/sup&gt;</td>
<td>Tamgadge et al</td>
<td>2012</td>
<td>Mumbai</td>
<td>70 years/ male</td>
<td>Left maxillary sinus region</td>
<td>Immunocompromised (hypertensive)</td>
<td>Diffuse swelling extending from left maxillary region and periorbital region with slight oedema of upper lip, measuring 3×4 cm; intraorally firm and non-tender mass is seen</td>
<td>Computed tomography (CT) scan: abnormal hypodense soft tissue in the left buccal and premaxillary spaces extending into the left buccal pad; abnormal soft tissue with air pockets that is seen in the left maxillary antrum widening the left ostiomeatal unit.</td>
<td>Caldwell-Luc procedure done</td>
<td>Not available</td>
</tr>
<tr>
<td>15</td>
<td>Aspergillosis of maxillary sinus in an uncontrolled diabetic</td>
<td>Barthuния et al</td>
<td>2017</td>
<td>Rajasthan</td>
<td>63 years/ female</td>
<td>Left maxillary sinus region</td>
<td>Immunocompromised (uncontrolled)</td>
<td>Pain and swelling in upper left back decayed tooth before 3 months, undergone</td>
<td>OPG: missing upper first and second molars, radiolucency extending from</td>
<td>Surgical debridement and irrigation done with combination of normal saline</td>
<td></td>
</tr>
<tr>
<td>Sr. No.</td>
<td>Title</td>
<td>Author</td>
<td>Year</td>
<td>Country</td>
<td>Age/sex</td>
<td>Site</td>
<td>Medical history</td>
<td>Clinical findings</td>
<td>Radiographic findings</td>
<td>Treatment done</td>
<td>Follow up</td>
</tr>
<tr>
<td>--------</td>
<td>------------------------------------------------------------------------</td>
<td>-------------------</td>
<td>------</td>
<td>---------</td>
<td>---------</td>
<td>-----------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
<td>-------------------------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>15.</td>
<td>Visual loss due to paranasal sinus invasive aspergillosis in a diabetic patient</td>
<td>Rallis et al</td>
<td>2014</td>
<td>Greece</td>
<td>37 years/male</td>
<td>Left maxillary sinus</td>
<td>Immunosuppressed (uncontrolled diabetic mellitus)</td>
<td>Persistent left side facial swelling, constant headache, ptoisis and paresis of all branches of left side facial nerve; clinically palatal ulceration noted with pseudo membrane</td>
<td>CT scan: tissue mass of enhanced density in the left maxillary sinus extending to the ipsilateral ethmoid, sphenoid sinuses, and adjacent tissues</td>
<td>Caldwell-Luc procedure done with conservative debridement of soft tissue mass</td>
<td>1 year</td>
</tr>
</tbody>
</table>
DISCUSSION

Generally, aspergillus infection is believed to be an opportunistic pathogen which is commonly seen in maxillary sinus due to the indirect inhalation of the spores of aspergillus species from the environment mixed with dust.25,26 About 10% of the case with sinusitis was found to be aspergilloma, predominantly maxillary sinus.27,28 Aspergilloma in maxillary sinus can extend to the orbit and cranial vault along the skull base in severe cases, which can be easily misdiagnosed as malignancy. Aerogenic theory states that the fungal accumulation in the sinus is due to the anaerobic conditions.29 Iatrogenic infection can also cause infection in maxillary sinus developed from any underlying dental procedures. Advanced imaging technique provides a good diagnostic background for detection of aspergilloma in maxillary sinus. Computed tomography demonstrates the accurate extent of aspergilloma in maxillary sinus or paranasal sinuses. In the culture medium, the fungal hyphae grow in a circular pattern because of its centrifugal linear growth thus develops into a ball-shaped mass.23 Histopathologic examination is considered to be the most reliable and accurate test to diagnose aspergilloma but it can be a slow process.26 These infections when diagnosed at the earliest can be treated without causing much tissue damages which may be challenging. The differential diagnosis of the maxillary sinuses include mucormycosis, lymphoma, syphilis, tuberculosis, Wegener’s granulomatosis and allergic fungal sinusitis.30 The standard management of aspergilloma in maxillary sinuses is considered to be surgical debridement and systemic antifungal therapy. Effective surgical treatment requires adequate exposure to remove all necrotic, devascularized tissue with the ultimate purpose to permit the antifungal agent to reach the involved site.30

From the present case report and the studies included within this review had typical characteristics of aspergilloma or aspergillosis. In this case report and systematic review of 16 case reports, we found that about 60% of aspergilloma or aspergillosis cases occurred was seen in male patients, when compared to 40% cases found in female cases which was consistent with the previous study by Rajeev et al identified aspergilloma in 41 cases showing male predominance, half of the patients were in the fourth decade. Most of the current literature aspergilloma had been a surgical series showing slight male predominance. Patients who were exposed to the spores of aspergillus species under favorable conditions at any age developed aspergilloma or aspergillosis. The cause of the gender difference was unknown. The gender difference may be attributed to the epidemiological characteristics of the underlying diseases, since aspergilloma occurs more often in patients with particular diseases.

Interestingly, there were very few cases which were reported with bilateral maxillary sinus or multiple paranasal sinus involvement. Maxillary sinus aspergilloma was usually seen unilaterally and bilateral lesions were very rare. 12% of the cases in this review
reported to have bilateral maxillary sinus aspergilloma, else all cases (88%) had been reported with unilateral maxillary sinus aspergilloma, with left maxillary more common when compared to right which is similar to the case report discussed above. Our results were in accordance with previous literature reported by Guerra et al a case of bilateral maxillary-ethmoidal sinus aspergilloma that occurred after bilateral endodontic treatment. This can be due to the dental procedures that perforate the sinus membrane can cause mucociliary paralysis and mucosal hyperemia, resulting in epithelial dysfunction in the maxillary sinus. Due to disturbances in mucociliary action, the natural sinus drainage deteriorates and an anaerobic environment associated with local tissue hypoxia.

The main predisposing factor for maxillary sinus aspergilloma was found to be any dental procedure like root canal therapy, extraction, filling or grafting procedure, which are exhibited as localized and mild pain. From the current case report and the included review articles showed several cases about 83% of the cases showing previous history of dental procedures, in that 42% was due to infection caused by previous extraction sockets and 41% was due to undergoing RCT. Until other paraanasal sinuses, aspergillus spores may also be transmitted to the maxillary sinus through an iatrogenic pathway associated with dental procedure because of the close relationship between the antral teeth and the sinus floor. The dentogenic factors like paraformaldehyde and zinc oxide were revealed to accelerate the growth of Aspergillus species. Similarly, several cases of aspergilloma in the literature have been detected in sinuses that had been perforated by a previous dental procedure, while the contralateral side remained unaffected. Root canal treatment and the previous dental procedure were considered to be etiologic factors for the occurrence of aspergilloma in our cases.

Aspergilloma is commonly underestimated in clinical care because the infection only becomes symptomatic after a long period of fungal contamination. It was reported that about 25% of the patient aspergilloma was diagnosed after 1 year, after the onset of symptoms. This result was consistent with the previous literature by Giardino et al a case of aspergilloma that arose 2 years after root canal therapy. In another case, Sohn et al reported a case of aspergillus 1 year after the patient had undergone sinus bone grafting. However, in some cases, the time of onset of the infection was shorter. This was because of the noninvasive character and slow progression of the lesion. Thus, it was critical to ensure adequate follow up after dental treatment involving the maxillary sinus.

The cases have been reported in healthy as well as immunocompromised individuals. About 43% of the patients in this review were immunocompromised patients whereas 56% of the patients were healthy without any known predisposing conditions including our case which showed aspergilloma involved in a healthy individual. Aspergilloma has found to be increasing over the last several years and has been associated with an increase in the number of patients with some form of immunodeficiency. The progression and prognosis of these diseases depended on the location and immunologic status of the patient and the possibility of invasive aspergillus infections was higher due to compromised immunity. The fungus entered the lung through the bronchi and produced localized bronchitis. The fungus then infiltrated through the wall into the adjacent pulmonary artery, producing thrombosis and infarction. As the fungi then proliferated rapidly through the hemorrhagic and infarcted lung, they produced a round expanding infarct.

Panoramic radiographic examinations were a straightforward way to evaluate the maxillary sinus bilaterally for the diagnosis of aspergilloma. In our review and presented case report about majority of the cases used CT and panoramic radiographic imaging technique, this may be due to which more precise examination with CT may be necessary to exclude other sinus diseases such as antrolith, osteoma, mucocele, B cell lymphoma, squamous cell carcinoma, adenoid cystic carcinoma and inflammatory myofibroblastic tumors, from the differential diagnosis. The extent of the lesion, bone involvement and erosion can also be evaluated using CBCT, which required a lower radiation dose, was cost-effective and was not time-consuming.

Aspergilloma is a fungal infection which carries a very good prognosis with surgical debridement, Caldwell-Luc procedure followed by an antifungal regimen. All the reported cases have shown complete recovery within a time period of 3-12 months of follow up. Also, there were no records of recurrence of fungal infection after the standard treatment protocol. Systemic antifungal therapy was not generally required. However, if symptoms persisted for a long time after surgery, an oral antmycotic drug may be required as an additional therapy. Nonetheless, clinicians should be careful about using these drugs because of severe adverse effects, such as nephotoxicity. Since bacterial superinfection can cause acute sinusitis attacks, an appropriate antibiotic therapy was recommended in order to avoid bacterial coinfections.

Various types of dental procedures that involve the maxillary sinus may make it easier for fungal sinusitis to develop, which was similar to other sinus infections. Clinicians should be aware of the possibility of a fungal etiology, particularly in cases that are resistant to treatment and should monitor patients if sinus perforation occurs during a procedure to reduce the risk of infection.

**CONCLUSION**

The clinical conclusions from the review and our reported cases shows that maxillary sinus is the most common site
for aspergilloma of all the paranasal sinuses with mild and localized pain being its common symptom. The confirmatory diagnosis of aspergillus infection can be established by histopathological examination of routinely stained H and E sections. The surgical debridement followed by antifungal regimen is the therapy of choice in cases of aspergillus maxillary sinus infection.

ACKNOWLEDGEMENTS

We thank all the staffs at the department of oral and maxillofacial pathology of our institution for useful discussions and excellent technical assistance.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES


