Imaging Science in Dentistry 2021; 51: 87-90
https://doi.org/10.5624/isd.20200227

Incidental finding of metastatic malignancy involving the sphenoid sinus on a cone-beam computed tomographic scan: A case report

Niloufar Amintavakoli[1,*]

[1]*Department of Oral and Maxillofacial Pathology, Radiology and Medicine, New York University College of Dentistry, New York, NY, USA*

ABSTRACT

The increased use of cone-beam computed tomographic (CBCT) scans has made it increasingly necessary to evaluate incidental findings on CBCT scans. This report describes the case of a 66-year-old female patient who presented to the Department of Oral and Maxillofacial Pathology, Radiology and Medicine at the College of Dentistry of the author's institution and underwent a CBCT scan for maxillary alveolar process implant planning. Upon evaluation of the CBCT scan, a radiopaque (soft tissue attenuation) mass in the left superior aspect of the nasal cavity and left locule of the sphenoid sinus with opacification of the left locule of the sphenoid sinus was incidentally noted. These radiographic findings were suggestive of a space-occupying mass with a high possibility of malignancy. A further medical evaluation confirmed renal cell cancer metastasis to the sphenoid sinus. This study shows the significance of reviewing the entire CBCT scan for incidental findings. ***(Imaging Sci Dent 2021; 51: 87-90)***

KEY WORDS: Radiography, Dental; Cone-Beam Computed Tomography; Incidental Findings; Sphenoid Sinus; Paranasal Sinus Neoplasms

In recent years, due to advances in technology in both dentistry and imaging, there has been an increase in the use of cone-beam computed tomographic (CBCT) scans, and the number of dental offices that use CBCT scans is growing from day to day. CBCT scans are available with different fields of views including small, medium, and large.[1,2] CBCT scans with medium or large fields of view may cover areas that may not be familiar for dentists without proper training in oral and maxillofacial radiology. The increased use of CBCT scans highlights the significance of incidental findings noted on these CBCT scans. As described by Edwards,[2] incidental findings can be described as "any abnormal or pathological finding that is unrelated to the original purpose of the imaging test or tests being performed." The presence of significant incidental findings in CBCT scans has been well-documented in multiple studies.[3] Although most incidental findings on CBCT images are non-life-threatening, the possibility of significant pathologies and malignancies has been reported.[3]

One of the areas captured on CBCT scans that is relatively unknown to dentists is the paranasal sinus. The findings related to paranasal sinuses on CBCT scans have particular significance due to their proximity to dental tissue.[4] Variations in the anatomy of the sinonasal cavity make it difficult for inexperienced eyes to recognize pathological findings,[5] and incidental findings in the sinonasal cavity have been reported and are relatively common.[2,3,5,6]

In the present report, a case of metastatic malignancy in the sphenoid sinus incidentally found on a CBCT scan is discussed. A 66-year-old woman presented for preoperative implant placement site assessment, and a metastatic malignant lesion was found after a complete review of the CBCT volume. This case underscores the importance of reviewing the entire volume of the CBCT scan regardless of the area of interest.

Case Report

A 66-year-old female patient with a medical history of

Received August 22, 2020; Revised November 27, 2020; Accepted December 4, 2020
*Correspondence to : Dr. Niloufar Amintavakoli
Department of Oral and Maxillofacial Pathology, Radiology and Medicine, New York University College of Dentistry, 345 East 24th Street, Room 827S, New York, NY 10010, USA
Tel) 1-212-998-9416, E-mail) na57@nyu.edu

Imaging Science in Dentistry · pISSN 2233-7822 eISSN 2233-7830

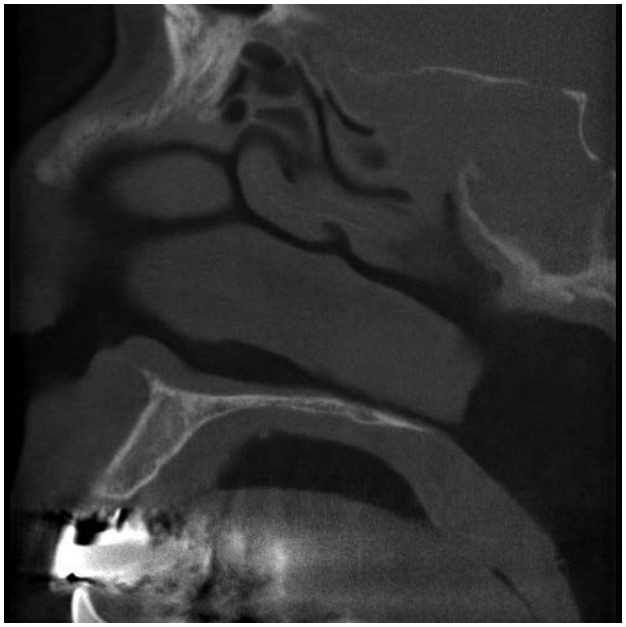

Fig. 1. Sagittal cone-beam computed tomographic image shows complete opacification of the left locule of sphenoid sinus and perforation of the anterior wall of the sinus.

Fig. 2. Axial cone-beam computed tomographic image shows a radiopaque (soft tissue attenuation) mass in the left sphenoid sinus and superior nasal cavity. The white arrow shows perforation of the anterior wall of the sphenoid sinus.

high blood pressure and removal of 1 kidney due to renal cancer presented to the College of Dentistry for evaluation of maxillary alveolar process implant placement. The patient was taking amlodipine (2.5 mg) and metoprolol (25 mg) for high blood pressure, and apixaban (2.5 mg) as a blood thinner. As part of treatment planning and after radiographic evaluation with conventional radiographs, a CBCT scan using 3D Accuitomo 170 (J Morita, Osaka, Japan) was acquired from the maxillary alveolar process. The field of view of the CBCT scan was 80 mm × 80 mm × 80 mm with a voxel size of 0.16 mm, and the exposure settings were 90 kVp, 6 mA, and 17.5 s. Upon review of the CBCT scan by an oral and maxillofacial radiologist, a well-demarcated and radiopaque (soft tissue attenuation) mass in the left superior aspect of the nasal cavity and the left locule of the sphenoid sinus was incidentally noted. This radiopacity extended from the left locule of the spheroid sinus anteriorly to the posterior aspect of the nasal cavity and measured approximately 26.45 mm and 19.35 mm anterior-posteriorly and medio-laterally, respectively. Figure 1 shows complete opacification of the left locule of the sphenoid sinus, left olfactory recess, and superior meatus in the sagittal view. The attenuation of the entity appeared to be homogeneous with no calcifications present inside. As shown in Figure 2, the entity remodeled and resorbed the anterior wall and the septation of the sphenoid sinus on an axial view. There was also complete opacification of the posterior left ethmoid air cells. Septation of the posterior air cells in this area was completely lost. The coronal view presented in Figure 3 shows the focal perforation of the cribriform plate

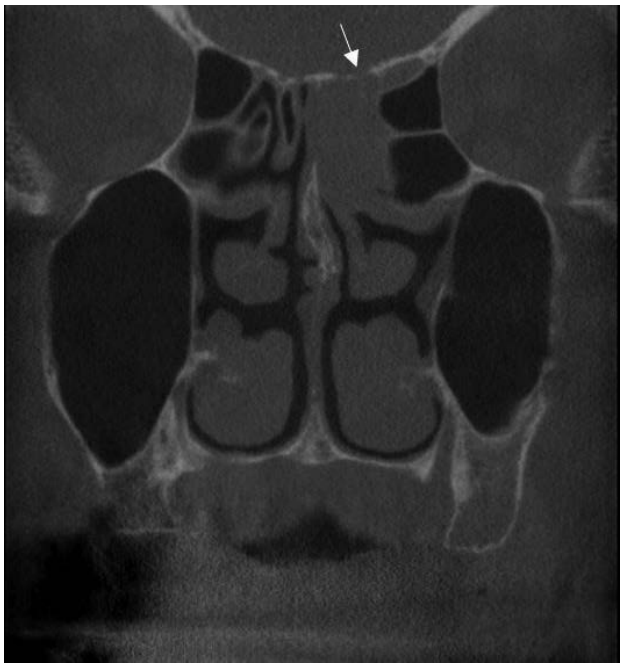

Fig. 3. Coronal cone-beam computed tomographic image shows the presence of a radiopaque (soft tissue attenuation) mass in the left superior nasal cavity and remodeling of the adjacent middle concha. Focal perforation of the cribriform plate is noted (white arrow).

adjacent to this mass in the ethmoid air cells. The presence of a mass in the superior aspect of the nasal cavity caused remodeling of the adjacent nasal septum. There was also remodeling of the adjacent left middle concha. Based on the presence of radiographic invasive behavior including perforation and remodeling of the adjacent cortical plates, a diagnosis of a space-occupying mass with a high possibility of malignancy was considered.

As a result of this finding, the graduate student assigned to this patient was contacted and the finding was communicated to the patient. The patient had a follow-up with her primary care provider and the lesion was further evaluated by more advanced imaging and biopsy, and the definitive diagnosis of metastasis of renal cell cancer was made.

Discussion

CBCT scans are widely utilized for various purposes, including evaluations of the airway, dental and jaw trauma, infections, temporomandibular joint pathologies, endodontic lesions, impacted teeth, developmental and congenital jaw deformities, and oral and maxillofacial pathology.[1,3,7] In recent years, with advances of technology in 3-dimensional printing and the introduction of the surgical guide implant planning, increasingly many private offices utilize CBCT machines, although the actual number of CBCT scan users in the United States is not known. The increase in the use of CBCT scans underscores the importance of a proper diagnostic evaluation of the entire CBCT volume. The American Dental Association, American Academy of Oral and Maxillofacial Radiology (AAOMR), and a joint statement of the AAOMR and American Association of Endodontists all emphasize the legal responsibility of clinicians regarding the interpretation of CBCT scans. Clinicians are not only responsible for the area of interest, but also for the entire volume of the scan.[8] One of the important factors in the evaluation of CBCT scans is clinicians' ability to recognize significant findings. Beacham et al.[9] reported an accuracy of approximately 60% in the interpretation of limited field-of-view CBCT scans by endodontists and endodontics residents. In another study, Ahmed et al.[10] reported a high rate of errors for missing lesions and false positives by orthodontists and orthodontic residents.

The incidence of incidental findings was reported to be 24.6% to 94.3% in a literature review by Dief et al.[3] Most of these findings were not life-threatening and included periapical pathology, soft tissue calcifications, and sinonasal and vertebral findings. They considered life-threatening findings to include carotid calcifications; benign neoplasms and cysts such as dentigerous cysts, ameloblastomas, giant cell lesions, nasopalatine duct cysts, and odontogenic keratocysts; and malignancies. Considering the large area that is captured in CBCT scans, the possibility of an incidental finding of malignancy on CBCT scans is relatively rare. The highest frequency of malignancies incidentally found on CBCT scan was reported by Warhekar et al.[11] as 1.4%. In another study, Allareddy et al.[12] reported 3 malignancies incidentally found in a sample of 1000 CBCT scans. One of these cases was in the region of the sella turcica, which is outside the area of dentists' interest.

The significance of radiographic interpretation is more evident in larger field-of-view CBCT scans. CBCT scans, especially those with medium and large fields of view, cover regions beyond the areas of dentists' knowledge. One of these areas is the sinonasal cavity, which is composed of 4 paired airspaces around the nasal cavity.[13] In a literature review, Dief et al.[3] reported that the rate of incidental findings of the airway spaces was 0.7% to 55.1%, with the highest incidence found for mucous retention, followed by sinusitis and concha bullosa. Dentists are mostly familiar with the anatomy and pathology of the maxillary sinuses because of their proximity to the alveolar process. However, large and even medium fields of view capture sinonasal cavity areas beyond the maxillary sinuses. The sphenoid sinus is in the base of the middle cranial fossa and in the body of the sphenoid bone inferior to the pituitary fossa. The olfactory nerves and optic chiasm pass superior to this area. The cavernous portions of the internal carotid arteries are lateral to the sphenoid sinus and the pterygoid canal often courses inferior to the mucosa of the sphenoid sinus floor.[13] The proximity of the sphenoid sinus to these vital structures underscores the importance of a proper evaluation of the sphenoid sinus on CBCT scans.

It has been reported that primary malignancies of the sphenoid sinus account for 1% of tumors in the paranasal sinus.[14] In the upper airway, the sphenoid sinus is the least common location of metastatic lesions, followed by the nasal cavity, frontal sinus, and ethmoid cells. The maxillary sinus is the most common location of metastatic lesions.[14] The clinical presentations are non-specific and include epistaxis, nasal obstruction, anosmia, diplopia, or pain.[14,15] In the present case, the patient did not show any clinical presentations related to the presence of the malignant metastasis to the sphenoid sinus, and the lesion was incidentally found on a CBCT scan that was acquired primarily for dental implant placement. This case and cases like this underscore the importance of evaluating CBCT volumes in their entirety, including findings beyond the area of interest.

Conflicts of Interest: None

Acknowledgments

The author would like to acknowledge the Department of Prosthodontics, College of Dentistry and Dr. Toni Sami, a postgraduate alumnus of Department of Prosthodontics, College of Dentistry.

References

1. Scarfe WC, Farman AG. What is cone-beam CT and how does it work? Dent Clin North Am 2008; 52: 707-30.
2. Edwards R, Altalibi M, Flores-Mir C. The frequency and nature of incidental findings in cone-beam computed tomographic scans of the head and neck region: a systematic review. J Am Dent Assoc 2013; 144: 161-70.
3. Dief S, Veitz-Keenan A, Amintavakoli N, McGowan R. A systematic review on incidental findings in cone beam computed tomography (CBCT) scans. Dentomaxillofac Radiol 2019; 48: 20180396.
4. Mutalik S, Rengasamy K, Tadinada A. Incidental findings based on anatomical location and clinical significance in CBCT scans of dental implant patients. Quintessence Int 2018; 49: 419-26.
5. Avsever H, Gunduz K, Karakoç O, Akyol M, Orhan K. Incidental findings on cone-beam computed tomographic images: paranasal sinus findings and nasal septum variations. Oral Radiol 2018; 34: 40-8.
6. Edwards R, Alsufyani N, Heo G, Flores-Mir C. The frequency and nature of incidental findings in large-field cone beam computed tomography scans of an orthodontic sample. Prog Orthod 2014; 15: 37.
7. Lopes IA, Tucunduva RM, Handem RH, Capelozza AL. Study of the frequency and location of incidental findings of the maxillofacial region in different fields of view in CBCT scans. Dentomaxillofac Radiol 2017; 46: 20160215.
8. Kim IH, Singer SR, Mupparapu M. Review of cone beam computed tomography guidelines in North America. Quintessence Int 2019; 50: 136-45.
9. Beacham JT, Geist JR, Yu Q, Himel VT, Sabey KA. Accuracy of cone-beam computed tomographic image interpretation by endodontists and endodontic residents. J Endod 2018; 44: 571-5.
10. Ahmed F, Brooks SL, Kapila SD. Efficacy of identifying maxillofacial lesions in cone-beam computed tomographs by orthodontists and orthodontic residents with third-party software. Am J Orthod Dentofacial Orthop 2012; 141: 451-9.
11. Warhekar S, Nagarajappa S, Dasar PL, Warhekar AM, Parihar A, Phulambrikar T, et al. Incidental findings on cone beam computed tomography and reasons for referral by dental practitioners in indore city (m.p). J Clin Diagn Res 2015; 9: ZC21-4.
12. Allareddy V, Vincent SD, Hellstein JW, Qian F, Smoker WR, Ruprecht A. Incidental findings on cone beam computed tomography images. Int J Dent 2012; 2012: 871532.
13. Parks ET. Cone beam computed tomography for the nasal cavity and paranasal sinuses. Dent Clin North Am 2014; 58: 627-51.
14. Tandon S, Nair A, Sawkar A, Balasubramanya AM, Hazarika D. Hepatocellular carcinoma presenting as an isolated sphenoid sinus lesion: a case report. Ear Nose Throat J 2012; 91: E10-3.
15. Morvan JB, Veyrières JB, Mimouni O, Cathelinaud O, Allali L, Verdalle P. Clear-cell renal carcinoma metastasis to the base of the tongue and sphenoid sinus: two very rare atypical ENT locations. Eur Ann Otorhinolaryngol Head Neck Dis 2011; 128: 91-4.