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Carotid artery calcification detected on the panoramic radiographs

KEYWORDS
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The panoramic radiography is a simple and useful aid in indicating patients at the high risk of cerebrovascular accident (CVA) due to the visibility of carotid artery calcification (CAC) on the panoramic radiographs, while the CAC was first described as the carotid arterial plaques identified on the panoramic radiographs in 1981.[1,2] The CAC is usually located at the carotid artery bifurcation areas. The verticolinear, nodular, or heterogeneous nodular radiopaque mass or masses can be found on the panoramic radiographs within the neck soft tissues adjacent to the cervical vertebrae C3–C4 (intervertebral junction) and approximately 1.5–2.5 cm posteroinferior to the bilateral mandibular angles. The CAC will further cause carotid artery stenosis, which is a very common ischemic vascular disease of the patients. In addition, almost 80% of strokes are ischemic, caused by atherosclerotic disease in the carotid artery branch areas. Therefore, the CAC identification is critical. Early detection, diagnosis, and related medical treatment of patients at the risk of CVA may reduce the prevalence of strokes, and the mortality and morbidity due to the CVA.[2]

In addition to high blood pressure, diabetes, and hyperlipidemia, receiving the radiation therapy for the head and neck cancers is also a risk factor for the CAC. The radiation generated during radiotherapy can easily damage vascular endothelial cells and cause blood vessel wall damages. These radiation effects can be seen several months after radiation and may last for years.[3] Usually after 5 years of radiotherapy, this phenomenon of blood vessel wall damages will gradually become apparent, causing the CAC and further increasing the risk of ischemic strokes. In this article, we reported the detection of the CAC at the right neck soft tissues on the panoramic radiographs of an adult female patient with experience in the head and neck radiation therapy.

This female patient (born in 1970) was first diagnosed with the nasopharyngeal cancer (cT4N2M0) by the National Taiwan University Hospital (NTUH) in September 2006. She received the radiation therapy and chemotherapy from November 2006 to January 2007. Thirteen years later, she received the balloon dilatation and placement of a carotid artery stent in the left carotid artery in December 2019. This left carotid artery stenosis was suspected to be related to the left carotid artery damage and the subsequent lesion caused by the radiation therapy. As time progressed, she was diagnosed with a malignant tumor of the right parotid gland by the NTUH in March 2023, and received the radiation therapy and chemotherapy again for the right parotid gland cancer from April 2023 to June 2023. She had received oral health care in our dental outpatient clinic for a long time. Therefore, we could retrospectively study the image changes corresponding to the bilateral carotid artery regions on her panoramic radiographs over many years, as a preliminary exploration of the relationship between the head and neck radiation therapy and the CAC (Fig. 1).

On the panoramic radiograph in September 2006, when this patient was first diagnosed with the nasopharyngeal cancer (cT4N2M0) and on that in March 2007, when she had completed the radiation therapy 2 months later, there

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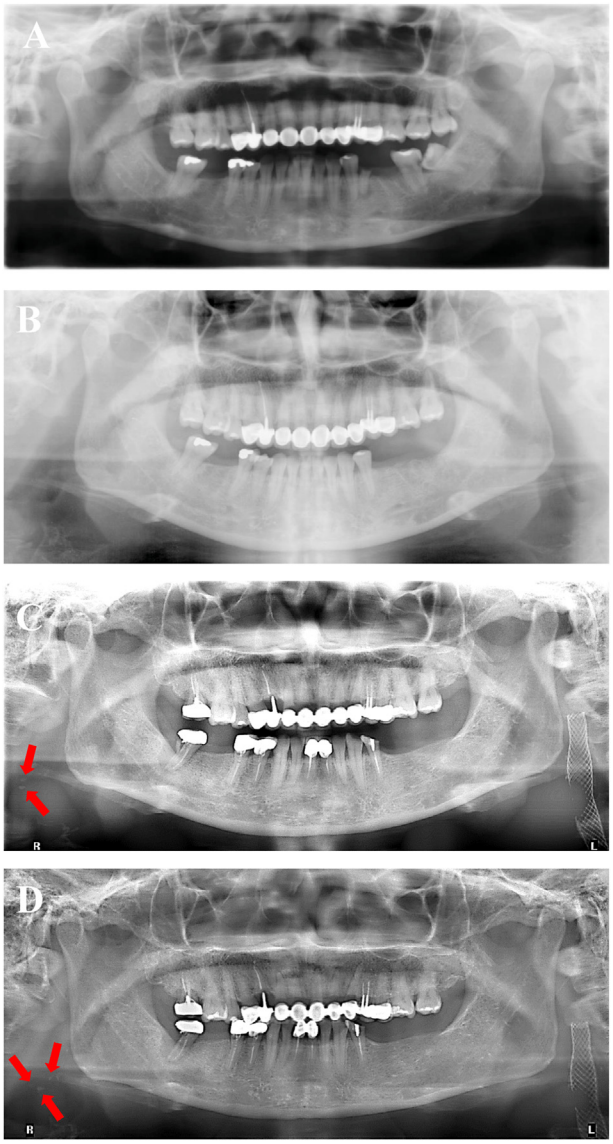

Figure 1 A series of panoramic radiographs of an adult female patient who was diagnosed with the head and neck cancers and received the radiation therapies in the National Taiwan University Hospital (NTUH) (A) On the panoramic radiograph in September 2006, when she was first diagnosed with the nasopharyngeal cancer (cT4N2M0), there was no verticolinear, nodular, or heterogeneous nodular radiopaque mass or masses found within the bilateral neck soft tissues adjacent to the cervical vertebrae C3–C4 (intervertebral junction) and approximately 1.5–2.5 cm posteroinferior to the bilateral mandibular angles. (B) On the panoramic radiograph in March 2007, when she had completed the radiation therapy 2 months later, there was still no verticolinear, nodular, or heterogeneous nodular radiopaque mass or masses found within the above-mentioned bilateral neck corresponding regions. (C) On the panoramic radiograph in July 2023, when she was diagnosed with the right parotid gland cancer and had completed the radiation therapy one month later, there were 2 nodular radiopaque masses (pointed by the two red arrows) found within the above-mentioned right neck corresponding region. In addition, the imaging feature of the placement of a mesh-like carotid artery stent after the balloon dilatation in the left carotid artery could be found. (D) On the panoramic radiograph in March 2024, when she had completed the radiation therapy 9 months later, there were 3 nodular radiopaque masses (pointed by the three red arrows) found within the above-mentioned right neck corresponding region.

was no verticolinear, nodular, or heterogeneous nodular radiopaque mass or masses found within the bilateral neck soft tissues adjacent to the cervical vertebrae C3–C4 (intervertebral junction) and approximately 1.5–2.5 cm posteroinferior to the bilateral mandibular angles (Fig. 1A and B). On the panoramic radiograph in July 2023, when she was diagnosed with the right parotid gland cancer and had completed the radiation therapy one month later, there were 2 nodular radiopaque masses found within the above-mentioned right neck corresponding region. In addition, the imaging feature of placement of a mesh-like carotid artery stent after the balloon dilatation in the left carotid artery could be found (Fig. 1C). Finally, on the panoramic radiograph in March 2024, when she had completed the radiation therapy 9 months later, there were 3 nodular radiopaque masses found within the above-mentioned right neck corresponding region (Fig. 1D).

In the present case, the nodular radiopaque masses were detected within the right neck soft tissues adjacent to the region of approximately 1.5–2.5 cm posteroinferior to the right mandibular angle on the panoramic radiographs. This characteristic radiographic feature was highly suspected to be the CAC due to the patient's medical history of the head and neck cancers and the radiation therapy. Thus, the first radiation therapy for the nasopharyngeal cancer was highly suspected to be the main cause of the left carotid artery stenosis. In addition, the cumulative damages to the right carotid artery caused by the first radiotherapy for the nasopharyngeal cancer and the second radiotherapy for the right parotid gland cancer were highly likely to be the etiologies for the right CAC. However, the CAC should be differentiated from anatomical structures such as epiglottis, hyoid bone, calcified stylohyoid ligament, and thyroid cartilages, as well as from pathological conditions such as phleboliths, sialoliths, tonsilloliths, and calcified lymph nodes.[2,4] Therefore, for detecting the CAC, further diagnostic procedures (such as neck ultrasound, computed tomography, and angiography examinations) should be performed to confirm the carotid artery stenosis due to the CAC.[5]

Considering the routine usage of panoramic radiographs for the clinical diagnosis and evaluation in today's dental procedures, as well as their ease of usage and low cost compared to other imaging methods, panoramic radiography can be considered an effective diagnostic tool in the detection of the CAC. The proper differential diagnosis requires new knowledge and further experience. Therefore, it seems crucial to incorporate the CAC assessment on the panoramic radiographs into the undergraduate dental curricula.[2] As a well-trained dentist, it is also one of our responsibilities to use the opportunity of interpreting panoramic radiographs to detect the possible lesions other than oral diseases for our dental patients.

Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

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None.

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