



CASE REPORT

Radio-induced osteosarcoma of the mandible: case report and literature review

Vitoria Nallin de Godoy^{1*} , Miguel Ângelo Benedicto Júnior¹ ,
Priscila Florêncio de Oliveira¹, Mariana Maiti Marcondes Silva¹, César Augusto Cardoso² 

Abstract

Radio-induced osteosarcoma of the head and neck is a rare yet malignant condition. This report describes a 62-year-old male patient who developed an osteosarcoma as a result of radiation therapy for his primary tumor located at the base of the tongue 12 years prior. The diagnosis of this specific tumor type is guided by criteria proposed by Cahan and Woodard, facilitating its early identification and treatment.

Keywords: osteosarcoma; neoplasms; radiation-induced; case reports.

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Introduction

Radio-induced osteosarcoma in the head and neck region emerges as a late complication of radiation therapy in areas previously exposed to this technique. Although rare, they are predominantly aggressive, necessitating early detection and, subsequently, early intervention. The diagnostic criteria proposed by Cahan and Woodard assist in identifying radio-induced sarcomas. These criteria are: 1) histological and radiological evidence of the absence of a prior tumor in the affected bone; 2) emergence of sarcoma in the irradiated area; 3) a span of at least 5 years between radiation exposure and the development of the malignant bone tumor; 4) histological confirmation of the sarcoma. This report presents the case of a 62-year-old man who developed a mandibular osteosarcoma as a result of radiation therapy for his primary tumor located at the base of the tongue 12 years prior.

Case report

SALF, a 62-year-old male, was under annual monitoring for a base of the tongue tumor (T4aN0M0 - Pathological diagnosis: Grade II squamous cell carcinoma) diagnosed in January 2010. He underwent conservative treatment concurrently with chemotherapy and radiation therapy, receiving a dose of 70 GY, which was completed in July 2010. Due to a recurrence in November 2010, surgical intervention was required. He underwent an extensive total glossectomy and supraomohyoid neck dissection. In July 2022, the patient returned complaining of pain in the right mandibular

¹Universidade de Taubaté (UNITAU), Departamento de Medicina, Taubaté, SP, Brasil

²Hospital Regional do Vale do Paraíba (HRVP), Serviço de Cirurgia da Cabeça e Pescoço, Taubaté, SP, Brasil

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branch for over 6 months, facial swelling, and pain upon superficial palpation (Figure 1). A computed tomography (CT) scan of the facial sinuses and neck revealed osteoblastic and osteolytic lesions in the right mandible extending to the temporomandibular joint (TMJ) with no soft tissue involvement (Figure 2). A biopsy of the lesion confirmed a neoplasm with osteogenesis and vascularized areas; immunohistochemistry (IHC) was consistent with telangiectatic osteogenic sarcoma with a positive Ki-67 (60-70%). After the diagnosis, the patient was referred to the Clinical Oncology Department for tumor staging and determination of conservative treatment. Between 24 Jan 2023 and 30 May 2023, the patient underwent six chemotherapy cycles with isolated Doxorubicin, because of good tolerability and the risk of toxicity in combination with Cisplatin (CDDP). CT scans of the facial sinuses and chest performed on 23 May 2023 revealed a new bone formation throughout the right hemi-mandible extending to the infratemporal fossa closely associated with the base of the skull (Figure 3), as well as pulmonary nodules. A bone scintigraphy ordered in the same month showed an increased uptake lesion in the trochanteric region of the right femur, consistent with the patient's pain complaint. Based on the evaluation from the Head and Neck Surgery team and the lack of possibility for oncological margins, the patient remains under the care of Clinical Oncology, which recommends chemotherapy with Ifosfamide combined with Mesna to manage the disease, with no projected end date.



Figure 1. Images of the otoscopic examination of the tumor located in the right jaw region of a 62-year-old male patient. **A** - Front view. **B** - Side view. Photos used with the patient's authorization.

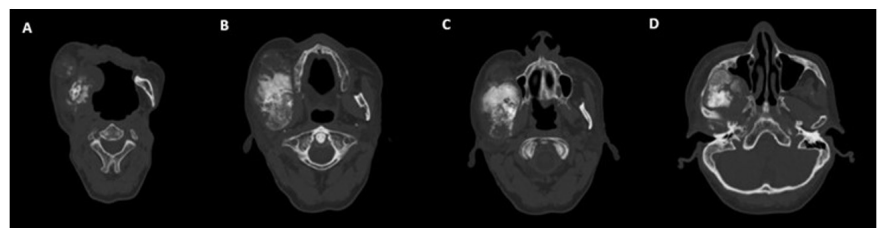


Figure 2. CT scan without contrast of the sinuses and neck (bone window), axial section, showing an extensive osteogenic lesion in the patient's right mandible. Sequential cuts at the level of: **A** - C2 body; **B** - articulation of the odontoid with C1; **C** - atlanto-occipital joint; and **D** - clivus.

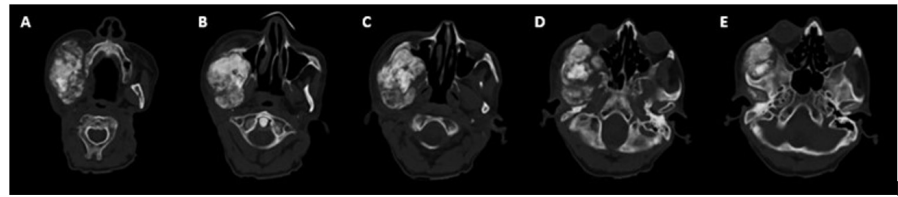


Figure 3. CT scan without contrast of the sinuses and neck (bone window), axial section, showing an increase in the initial osteogenic lesion, expanding to the base of the skull. Sequential cuts: A - at the level of the C2 body; B - at the level of the odontoid articulation with C1; C, D and E - sections from the pterygoid fossa to the level of the clivus.

Discussion

Radiation-induced sarcomas (RIS) are rare tumors. Given their evident treatment foundation in head and neck cancer, the use and increased accessibility of radiation therapy, combined with population growth, improved diagnostics, and long-term patient survival, there has been a rise in the frequency of these sarcomas^{1,2}.

The development of RIS can be influenced by radiation dosage, age at initial exposure, genetic factors, exposure to chemotherapy agents, and it does not favor specific areas³. Concerning radiation dose, there is no safe threshold below which there is no risk of inducing tumors. However, studies show that patients who received an average dose of 62 Gy for curative treatments of the primary tumor are already at risk², as is the case with the patient above, considering the radiation dose used was 70 Gy, above average. Regarding latency time, there is a variation depending on the patient's age at the first treatment. The average latency is 11 years, but it increases the younger the patient is². In the reported case, the time between radiation therapy and the emergence of the malignant tumor was 12 years, meeting one of the criteria proposed by Cahan and Woodard.

Moreover, among the histological types of RIS, osteosarcoma is the most common⁴, as evidenced by the most recent pathological anatomy of the case, followed by undifferentiated pleomorphic sarcoma and fibrosarcoma. Generally, patients have a poor prognosis, with a 5-year survival rate ranging from 24.2 to 38.2%².

It is essential to emphasize that these potential late sequelae of radiation therapy are often under-diagnosed because of their similarities with more common complications like radionecrosis². Computed tomography (CT) scans of the facial sinuses and neck identify soft tissue masses, bone destruction, and tumor formation due to osteogenesis⁵, features found in the imaging of the patient above, along with clinical symptoms of swelling and pain upon superficial palpation of the right mandibular region.

As RIS are rare and encompass various variables, there is no definitive treatment recommendation. In resectable cases, surgery is the preferred option, and in non-resectable cases, standalone radiation therapy or combined with systemic treatment emerges as a potential therapeutic foundation despite the high radiation risks². In the case above, given the lesion's irresectability and metastatic involvement, isolated chemotherapy with Ifosfamide in combination with Mesna, an antidote developed to counteract the toxic effects of chemotherapy, was indicated.

***Correspondence**

Vitoria Nallin de Godoy
Universidade de Taubaté (UNITAU),
Departamento de Medicina
Avenida Tiradentes, 500, Campus
Bom Conselho, Jardim das Nações
CEP 12030-010, Taubaté (SP), Brasil
Tel.: +55 (19) 995151881
E-mail.: vitoria.ngodoy@unitau.br

Authors information

VNG, MÂBJ, PFO, MMMS -
Medical graduate students.
CAC - Postgraduate in Palliative Care;
PhD in Sciences, Universidade de
São Paulo; Head and neck surgeon
in the city of Taubaté; Assistant
Professor, Universidade de Taubaté
in the disciplines of Medicine and
Spirituality, Clinical Surgery, Oncology
and Trauma; Coordinator, Trauma
Internship, Universidade de Taubaté,
Thyroid Group of Vale do Paraíba.

Conclusion

Radiation-induced osteosarcomas are rare compared with other types, but they have a worse prognosis. Early identification of this complication in patients previously exposed to radiation therapy for other tumors is crucial. The criteria proposed by Cahan and Woodard are instrumental in diagnosing these sequelae, which are often under-diagnosed.

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