The Yale Larynx Laboratory

A Clinical Review

Osteoradionecrosis

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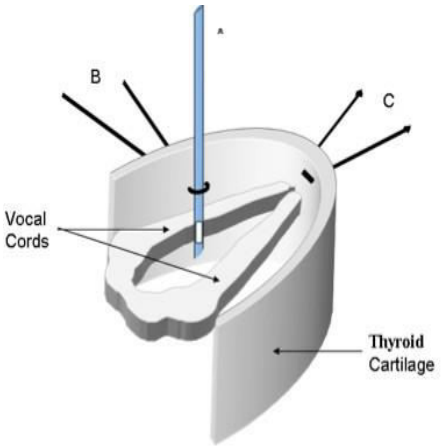

Laboratory Note

The purpose of this newsletter is to update our readers with the evidence-based management of certain Head & Neck disease presentations. In this issue we shall focus on mandibular osteoradionecrosis.

The Yale Larynx Laboratory was founded by John A. Kirchner in 1967. Since 1975 this laboratory has been in continuous operation under the direction of Clarence T. Sasaki, the Charles W. Ohse Professor and has been funded by the National Institutes of Health and by endowments of grateful patients.

Case Presentation

The patient is a 61 year old man with a history of base of tongue squamous cell carcinoma that was treated with radiation therapy ten years prior. Six months ago, he received dental work including several dental extractions. The patient presented with a pathologic fracture of his right mandible.

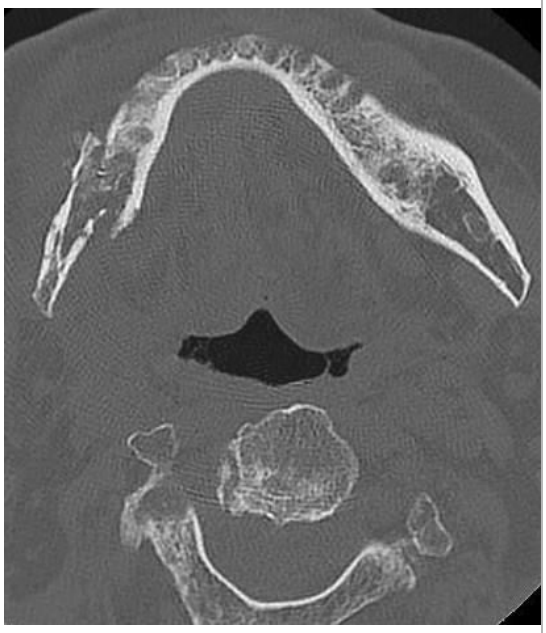

Fig. I

Clinical Findings

Physical examination revealed a thin man in no apparent distress. Neck palpation demonstrated induration bilaterally. There was exposed bone visible anterior to the angle of the right mandible. A CT dentascan was performed that showed findings consistent with a pathologic right mandibular fracture, secondary to osteoradionecrosis (Fig 1).

Course

The patient was taken to the operating room for a right composite resection, neck dissection, and left fibula free flap reconstruction of his mandible. (Fig. 2, 3, 4) All necrotic bone was included in a segmental resection and intraoperative cultures demonstrated Bacteroides fragilis. Appropriate antibiotics were instituted and the patient was followed by the infectious disease service for six weeks of antibiotic treatment.

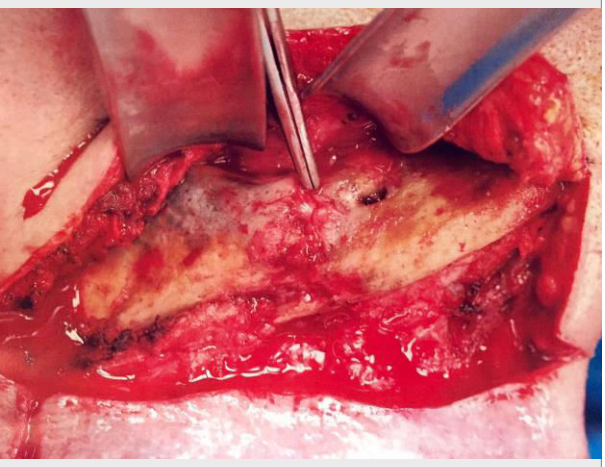

Fig. 2 Mandibular osteomyelitis and pathologic fracture.

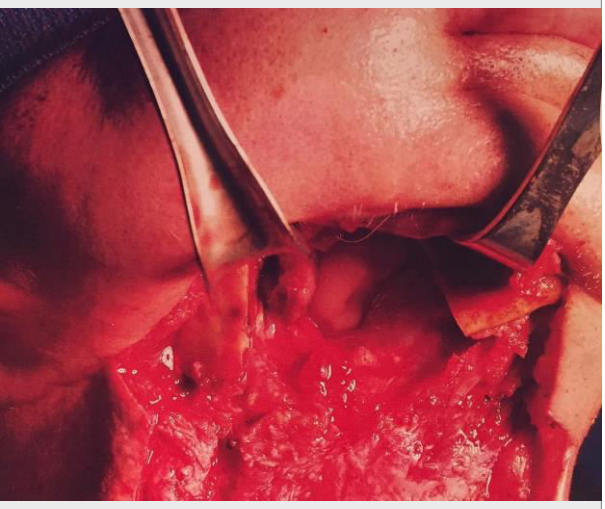

Fig. 3 Segmental mandibular resection completed.

Upon outpatient follow up, his weight was noted to be stable. His reconstructed right mandible appeared intact, mechanically stable, and well healed.

Discussion

In 1926, Ewing first recognized the bony changes associated with radiation therapy and described this disease as "radiation osteitis".[1] Osteoradionecrosis (ORN) is a potentially chronic side effect of radiation therapy for patients with head and neck cancers that can occur at any time, but 70–94% of cases have been reported to develop within the first 3 years after radiotherapy.[2] ORN is defined as an area of exposed, devitalized, irradiated bone that fails to heal over a period of 3-6 months in the absence of local neoplastic disease.[3]

The incidence of ORN in the head and neck–irradiated population was estimated to be 4.74% - 37.5%.[4] Marx offered the principles of hypocellularity and hypovascularity to explain the pathophysiology of osteoradionecrosis. In the head and neck, there are several factors that place the mandible at increased risk when compared to other bones in the craniofacial skeleton, most likely due to its relatively poor vascularity. Others suggest that it can be attributed to the fact that the mandible is included in the radiation field more frequently than the maxilla.[5]

There is a direct relationship between the total radiation dose and the incidence of osteoradionecrosis, with a threshold of 5000 cGy. When the total radiation dose is 7000 cGy or greater, there is 10 times the relative risk of osteoradionecrosis. In addition, the mechanism of radiation delivery can significantly impact the development and severity of necrosis, with brachytherapy implants having the greatest relative risk in combination with external beam exposures of 6500 cGy.[7] In a study by Kuluth et al, there was a statistically significant incidence of osteoradionecrosis in patients with more advanced tumors (stage III or IV), recurrent tumors, tumors involving the tongue, retromolar trigone, and floor of mouth, and clearly with tumors invading bone.[8]

Established ORN has a varied presentation ranging from mild asymptomatic disease to severe pain, fistulas, suppuration, exposed bone, and pathological fracture.[9]

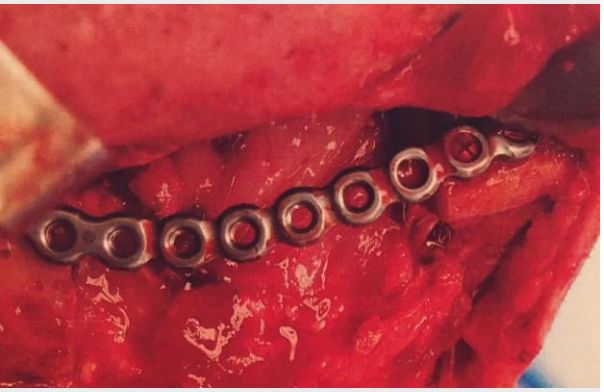

Fig. 4 Vascularized fibula inset and stabilized.

Kagan and Schwartz described a three stage clinical staging system. Stage I is defined as minimal soft tissue ulceration and limited exposed cortical bone. Stage II is defined as localized involvement of the mandibular cortex and underlying medullary bone. Stage III is classified based on full thickness involvement of the bone, including the inferior border.[9]

In some hands, Stage I ORN is managed conservatively (local wound care with or without Hyperbaric oxygen (HBO), and antibiotics). Conservative management has traditionally involved sequestrectomy and HBO that theoretically enhances neovascularization and wound healing, but more recently, medical management with pentoxifylline, tocopherol and clodronate has been introduced. Advanced disease (Stage III) is managed surgically with a wide resection and immediate microvascular free flap reconstruction. It is the intermediate stage disease (Stage II) for which it remains difficult to recommend a definitive treatment course. There are intermediate stage patients who will respond to transoral debridement, HBO, and antibiotics. There is also a subset of intermediate stage patients who do not respond to this treatment plan and ultimately require a segmental resection and reconstruction.[10,11] A Cochrane review concluded that although there is some evidence that HBO improves outcome, further large randomized trials of "high methodological rigour" are needed.[12] Of note, a randomized controlled trial by Annane et al. concluded that HBO is not better than placebo.[13]

The precautions that could be taken include prophylactic oral care prior to, during and following completion of RT. During the early post-treatment period, the patient should visit the dentist every 4 months.[11] All anticipated dental extractions should be completed prior to RT.

In general at our institution we do not favor HBO because of its undocumented efficacy and because of its theoretical potential to enhance neoplastic growth nor do we support decisions for early dental implants that threaten the closed integrity of the irradiated mandible. Consistent with prevailing practice we will use microvascular reconstructive methods as opposed to free bone grafts especially when operatively open to the oral cavity.

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