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Osteoradionecrosis (ORN) Of The Jaws–A Review

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ABSTRACT

Introduction : Osteoradionecrosis (ORN) is the common complications of radiation therapy in the head and neck cancer patients. In the history, REGAUD was the first to report about osteoradionecrosis. Later, several criterion are meant for osteoradionecrosis. Several staging or scorings/classifications are given based on clinical findings, radiographic findings, extent of the involvement, response to treatment, etc. Clinically it manifest as ulceration or exposing the necrosed bone or necrosed mucosa. Radiographic features are evident in later stages. We the clinician should be aware and diagnosed early without leading it to further sufferings to the patient.

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1. INTRODUCTION

In India, almost all of the cancers are mostly detected at the late stage or early late stages, which are managed by excision of the site followed by radiation therapy. One of the most common and serious complication of the radiation therapy in the maxillofacial region is the Osteoradionecrosis (ORN). It is an inflammatory condition of the bone which arises after 5 years of radiation therapy. The radiated bone becomes necrotic and exposed. It is characterized by the presence of unhealed, exposed bone for a period of atleast 3 months after delivery of the radiation therapy happening at any time(1),(2).

HISTORY:

In 1922, "REGAUD" reported the first evidence of ORN related to radiotherapy(1). After that, in 1926 "EWING" described the pathology of ORN under the name ‘radiation osteitis’. Later on, "MEYER" classified ORN as one of the special type of ‘osteomyelitis. Followed by "TITTERINGTON"also related ORN to osteomyelitis, and used the term ‘osteomyelitis of irradiated bone’. Future more, "MARX" defined it as an area greater than 1 cm of exposed bone in a field of irradiation that had failed to show any evidence of healing for at least 6 months. He also clarified that in ORN there is no interstitial infection, but only superficial contamination(3).

CLASSIFICATION:

In the literature, many authors classified ORN according to the bone exposed, clinical findings, radiographic findings, response to treatment, etc.

Coffin classified ORN according to the clinical and radiographic findings into 2 stages(2);

STAGES	FINDINGS
Minor	A series of small sequestra which separates spontaneously after varying periods of weeks or months, which cannot be seen radiographically
Major	Necrosis occurring to an extent that involves the entire thickness of the jaw, and a pathological fracture is inevitable and seen radiographically

Marx classified ORN according to the HBO therapy response(3),(4),(5);

STAGES	FINDINGS
Stage I	Exposed bone without pathologic fracture, which responds to HBO therapy
Stage II	Exposed bone does not respond to HBO therapy, and requires sequestrectomy and saucerization
Stage III	Full-thickness bone damage or pathological fracture usually requires complete resection and reconstruction with free tissue.

Notani et al classified based on clinical findings(1),(3),(5);

STAGES	FINDINGS
Stage I	ORN confined to alveolar bone
Stage II	ORN limited to the alveolar bone and/or mandible above the level of the inferior alveolar canal
Stage III	ORN involving the mandible below the level of the inferior alveolar canal and/or skin fistula and/or pathological fracture

II. CLINICAL FINDINGS:

The ORN most commonly seen in the mandible than in the maxilla because of the microanatomic structures and vascularity that is maxilla has blood supply via the arteries and through the porous bone structure. Other than that, most of the tumors occur in the mandible especially in the posterior mandible. Hence, the common site of the ORN is the posterior segment of the mandible. It is presented as yellowish to greyish colour bone exposed with loss of mucosal and/or skin covering which is the hallmark of ORN. The exposed bone becomes necrosed from periosteum and sequestra because of less vasculature. Pain may or may not be present according to the involvement with extraoral or intraoral swelling showing asymmetric face associated with discharge or drainage and extraoral or intraoral fistulas in severe cases. The surrounding tissue will be inflamed and ulcerated from recurrent infections or tumor. There will be trismus with fetid breath associated with raised temperature and pathological fractures will benoted in acute cases (3),(4),(6).

Source: Osteonecrosis of the jaw: Treating bone loss triggered by drugs for osteoporosis, cancer https://utswmed.org/doctors/thomas-schlieve/

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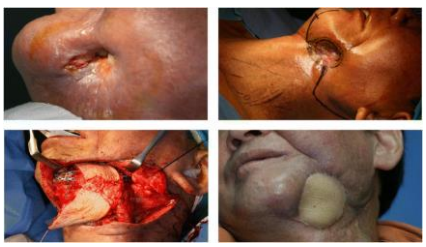
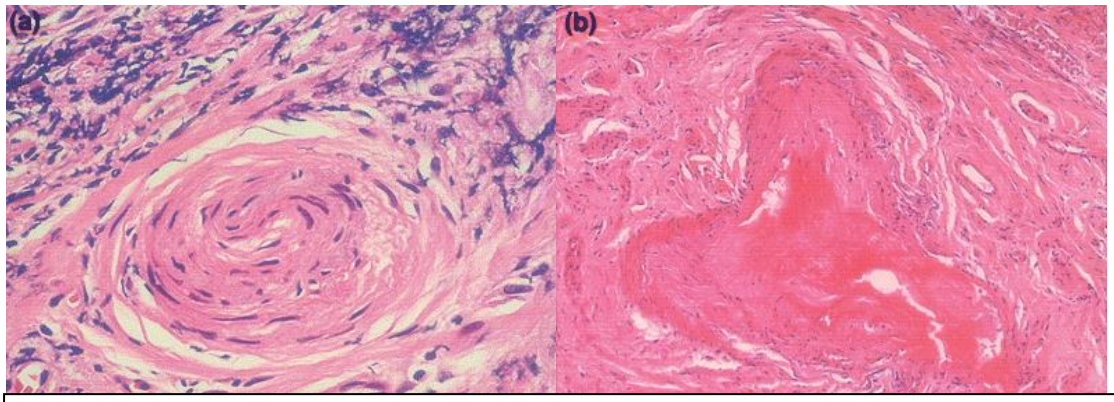


Reconstruction with fibular osteocutaneous free flap in patients with mandibular osteoradionecrosis December 2015Maxillofacial Plastic and Reconstructive Surgery 37(1):7DOI:10.1186/s40902-015-0007-3SourcePubMed

Osteoradionecrosis in cancer patients: The evidence base for treatment-dependent frequency, current management strategies, and future studiesAugust 2010Supportive Care in Cancer 18(8):1089-98 DOI:10.1007/s00520-010-0898-6 SourcePubMed

HISTOPATHOLOGICALFINDINGS:

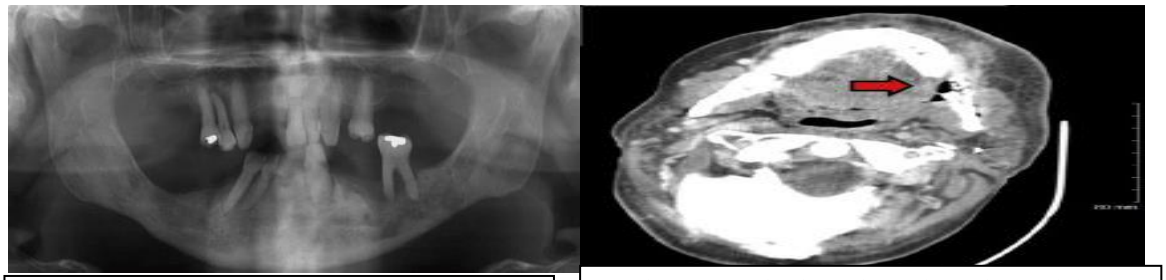
In H&E staining, it looks like amicro-anatomic desert. There is destruction of osteocytes, absence of osteoblasts and lack of new bone or osteoid formation.The walls of the regional blood vessels are thickened by fibrous connective tissue. The loose connective tissue replaces the bone marrow is infiltrated by lymphocytes, plasma cells and macrophages (6),(7).



Osteonecrosis of the jaws in patients treated with bisphosphonates – histomorphologic analysis in comparison with infected osteoradionecrosis Torsten Hansen, Martin Kunkel, Achim Weber, C. James Kirkpatrick First

RADIOGRAPHIC FINDINGS:

Computed tomography (CT) imaging is the modality of choice for ORN investigation. In early changes, the bone is well defined showing areas of resorption within the outer cortical plate of mandible. In later changes, it shows lytic or sclerotic or mixture appearance. Most commonly in posterior mandible with ill-defined periphery and range of bone formation and resorption occur. The bone pattern is granular. In rare cases, stimulated periosteal bone formation resulting in bone formation on outer cortexwill be noted. In the alveolarprocesses of maxilla and mandible there is irregularwidening of periodontal membrane space(3).



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Osteoradionecrosis: Exposing the Evidence Not the BoneAndrew J. Frankart, MD;Michael J. Frankart, DMD; Brian Cervenka, MD; Alice L. Tang, MD Deepak G. Krishnan, DDS; Vinita Takiar, MD, PhD ;Published:January 03, 2021DOI:https://doi.org/10.1016/j.ijrobp.2020.12.043

III. DIFFERENTIAL DIAGNOSIS:

Bone resorption alone can occur after the radiation therapy; this can be differentiated by the exposed bone in ORN. In Chronic osteomyelitis, the bone will be exposed and can be differentiated by the history of irradiation(7).

MANAGEMENT OF ORN:

ORN can be managed by conservative approach and non-conservative method. The aim of the conservative approach is to make the patient to feel pain free and to maintain the site infection free. This can

be done by administration of antibiotics, analgesics, nutrition and hydration and also by sequestrectomy, local debridement(6).

• HYPERBARIC OXYGEN THERAPY (HBO):

Patient is placed in a closed chamber and giving 100% oxygen through the mask at 2.4 absolute atmospheric pressure for 90 minutes for 5 days a week. Thus, it reduces the hypoxia and increases the healing process by increasing the arterial and venous O^2 tension(1),(6).

RECENT ADVANCES:

- ❖ Combined drug therapy
- ❖ Laser therapy combined with photodynamic therapy
- ❖ Intensity modulated radiation therapy

➢ **Combined drug therapy:**

One of the recent advances is the administration of pentoxifylline-tocopherol and Clodronate therapy. This combined therapy reduces the chronic progressive septic ORN of the mandible. These drugs act synergistically as potent antifibrotic agents. Pentoxifylline has a negative effect on TNF-α, dilates blood vessels, increases erythrocyte flexibility and collagenase activity, inhibits inflammatory reaction & the proliferation of human dermal fibroblasts and the production of extracellular matrix. Along with tocopherol, it reduces fibrosis by scavenging the reactive oxygen species that were generated during oxidative stress, protecting cell membranes against the peroxidation of lipids, and partially inhibiting TGF-β1 and the expression of procollagen genes. While clodronate is a new generation bisphosphanates, inhibits bone resorption by acting directly on osteoblastic cells thereby, increasing the formation of bone and reducing the proliferation of osteoclasts and fibroblasts(6).

➢ **Laser therapy combined with photodynamic therapy:**

Low-level laser therapy increases cellular metabolism, promoting angiogenesis, and providing a degree of analgesia through neurotransmitter modulation. Photodynamic therapy involves the application of light in the setting of photosensitizer administration to generate reactive oxygen species thereby reducing the microbes. Thus combining the laser therapy with Photodynamic therapy will provide a beneficial effect to the patients(4).

➢ **Intensity modulated radiation therapy:**

Advances in the delivery of radiation remedy such as depth modulated radiation therapy (IMRT) holds promise to inhibit the incidence of osteoradionecrosis (ORN) with the utilizable resource of growing the conformity of the immoderate dose prescription to spare giant volumes of mandible and adorn homogeneity of dose. The quintessential therapy elements that have an effect on the chance of developing ORN consist of consummate dose of radiation (>60 Gy), extent of mandible receiving that dose, the segment of the mandible that is irradiated and dose fractionation (fraction sizes > two Gy). A discover out about evaluating 3D and IMRT approaches, validated that when restricted congruously, the extent of mandible receiving more than 50, 55 and 60 Gy ought to be decremented in oral most cancers sufferers present process IMRT. Thus, to date the splendid consequences with IMRT with regard to ORN exhibit up to be when the dose to organs at hazard (mandible, oral cavity and parotid) is constrained, traditional fractionation is utilized, and meticulous dental hygiene is applied(1),(6),(7).

CONCLUSION:

Patients undergoing radiation therapy in the head and neck region should be screened thoroughly by the dental practioners. Even not noticing a small DC can lead to serious complications in radiation therapy patients. Hence, it is the foremost and needed duty of dentist to screen. By regular follow up and early proper diagnosis the ORN can be prevented(7). The management of osteoradionecrosis is a multidisciplinary approach. Recent advances in the field made the management of ORN effective. Combined treatment therapy shows better response in the management.

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