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A Rare Case Report of Radionecrosis Mandible after Irradiation for Breast Cancer

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Case Study

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ABSTRACT

Management of irradiated patients with cancer in the head and neck region is a challenging scenario. Radiotherapy promotes cellular and vascular insufficiency that results in a low response rate in the healing. Consequently, surgical procedures in irradiated tissues present high rates of complication. Osteoradionecrosis (ORN) is the most severe sequelae caused by radiotherapy. ORN can occur due to multiple reasons, of which periodontal disease, traumatic injury induced by ill-fitting dentures and trauma after surgery or tooth extraction are the most common. The management of this side effect is difficult and can result in bone or soft tissue loss, affecting the quality of life since majority of patients with ORN have various comorbidities associated. In this article we present a case report of osteoradionecrosis secondary to irradiation for breast cancer which is not frequently reported in literature.

Keywords: Osteoradionecrosis; radiation; breast; mandible.

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1. INTRODUCTION

Radiotherapy is one of the important treatment modality in the management of malignant disease of the head and neck. Radiotherapy destroys all the cells with a high turnover rate [1]. Even though bone is radio-resistant compared with other tissues, radiotherapy will seriously compromise in its blood supply and reparative ability. Osteoradionecrosis (ORN) is one of the most severe complications of radiation therapy [2]. Marx (1983) defined ORN as an area greater than 1 cm of exposed bone in a field of irradiation that failed to show any evidence of healing for at least 6 months [3]. Since majority of patients with ORN have various comorbidities associated, it is difficult to treat and often leads to poor outcome and deformity. ORN can occur due to various reasons, of which periodontal disease, traumatic injury induced by ill-fitting dentures and trauma after surgery or tooth extraction are the most common [2]. ORN is seen to be dependent on the technique of the radiotherapy used, in particular—the radiation dose to the bone. A total dosage of approximately 6500 to 7000 uGy or greater, particularly to the floor of the mouth and mandible significantly show elevated incidence of ORN of the mandible [3]. Dose rates in excess of 0. 55 uGy/hour have also been seen to elevate the risk of ORN. ORN of mandible secondary to breast irradiation is not frequently reported in literature since site of irradiation in breast cancer is chest wall which is distant from mandible and this makes our case report unique.

2. CASE REPORT

A 73-year-old lady reported to our department of maxillofacial surgery in Pushpagiri Medical College Hospital, thiruvalla on 2020 with complaints of pain and swelling in the lower right back tooth region since three months duration. She was diabetic, dislipidemic and hypertensive and was having claustrophobia. Patient had no history of any pernicious habits. Patient also gave a history of breast cancer two year back (T2N2M1). For this she underwent left radical mastectomy and adjuvant chest wall RT with 5000 cGy in 25 fractions. This was followed by adjuvant chemotherapy with 8 cycles of 5-florourasil, epirubicin, and cyclophosphamide after surgery. Dental extraction of 47 was done 3 months after the radiation therapy from an outside dental clinic. Since then she gives a history of continuous pus discharge from the extraction socket (Fig. 1). There was no associated draining sinus or associated lymphadenopathy. She first consulted a local dental clinic and was given antibiotic course of Tab Moxclav 625-mg thrice daily for one week. The symptoms subsided after antibiotic therapy. However the symptoms had aggravated again after the antibiotic course.

On examination, a non-healing extraction site was seen in relation to 47 with pus discharging from the extraction socket with obliteration of buccal vestibule and erythematous swollen area from 45 to 48. Paresthesia in relation to lateral one third of right lower lip was also noted. The site was non tender on palpation.

3. INVESTIGATIONS

The symptoms of patient were typical to osteoraionecrosis. However patient hadn't undergone radiotherapy for maxillofacial area. The pus was sent for culture and sensitivity, which revealed presence of aerobic streptococcus viridian's species (alpha haemolytic). For a conclusive diagnosis, a biopsy was performed after three weeks therapy with Tab Pentoxyfilline 400mg thrice daily and Cap Evion 600mg twice daily, which showed necrozed bone along with granulation tissue. Routine blood examinations revealed a slight elevation in creatinine level. C reactive protein was also elevated slightly. An orthopantomogram (Fig. 2a) was taken which showed moderate bone loss in relation to extraction site. Computed tomogram (Fig. 2b) mandible revealed ill-defined oblong area of mixed sclerosis and intramedullary lucency involving the body of mandible on right side with cortical defects and sequestrum. Since the necrosis was confined above the inferior alveolar canal it was classified as stage ii Notani classification.

4. MANAGEMENT

Initially a conservative management was planned and patient was given ampicillin 500mg, 6 hourly for 7 days, pentoxifyllin 400mg three times daily, and tocopherol 1000 IU daily therapy for 6 months. But even after long term medical management, symptoms didn't subside. Hence surgical management under general anesthesia was planned. Prior to surgery, the site was irrigated daily with saline-betadine solution in 1:1 ratio, Tab Pentoxyfilline 400mg TID and Cap Evion 600mg BD was given for one week. Daily irrigation reduced the pus discharge. After substantial decrease in pus discharge, surgery was performed under general anesthesia after obtaining written informed consent from patient.

The defect was only below 5cm without continuity defect and we had advised reconstruction with ileac bone graft. But patient was not willing for any reconstructive options. Following intraoral debridement, sequestrectomy and saucerization, a small pediatric nasogastric feeding tube 6 to 10 inches long in length was placed against the bony bed and secured in the vestibule with 4-0 silk sutures (Figs. 3, 4, 5). Local drug delivery with gentamycin was given through the infant nasogastric tube for one week. Along with that Inj Accuzone plus 1.5g IV BD, pentoxyfilline and evion was administred.

The patient was discharged after one week. At that time the surgical site has healed completely and the patient is in periodic follow up since then. We had advised prosthetic rehabilitation, but she was not willing for such options of management.

Necrosis of the mandible following breast irradiation is not reported in literature. During head and neck irradiation, dental surgeons delay the extraction procedures for 6 months post irradiation. But here in this case since the field of irradiation is a distant site from the mandible and the possibility of necrosis is not expected. That may be the reason why that the dentist had performed extraction 3 months after breast irradiation. The only possibility to develop necrosis of the mandible in this case might be a supraclavicular field of irradiation.

It is recommended to do an MRI to assess the soft tissue changes, but since the patient was claustrophobic we couldn't do that. Also before performing surgical intervention hyperbaric oxygen therapy is often recommended. But here in this case, since the patient was claustrophobic we couldn't advise hyperbaric oxygen therapy also.

5. DISCUSSION

Malignant diseases of maxillofacial region are treated by (i) radiation therapy, (ii) surgery, (iii) chemotherapy, and (iv)combination therapy. Radiation often has serious effects on hard and soft tissues. Because of its inorganic composition, bone absorbs more energy than soft tissue and is more susceptible to radiation induced injuries. The effects of radiation on bone depend on the following four factors, viz: 1. Quality of radiation 2. Quantity of radiation 3. The location and extent of lesion 4. Condition of teeth and periodontium.

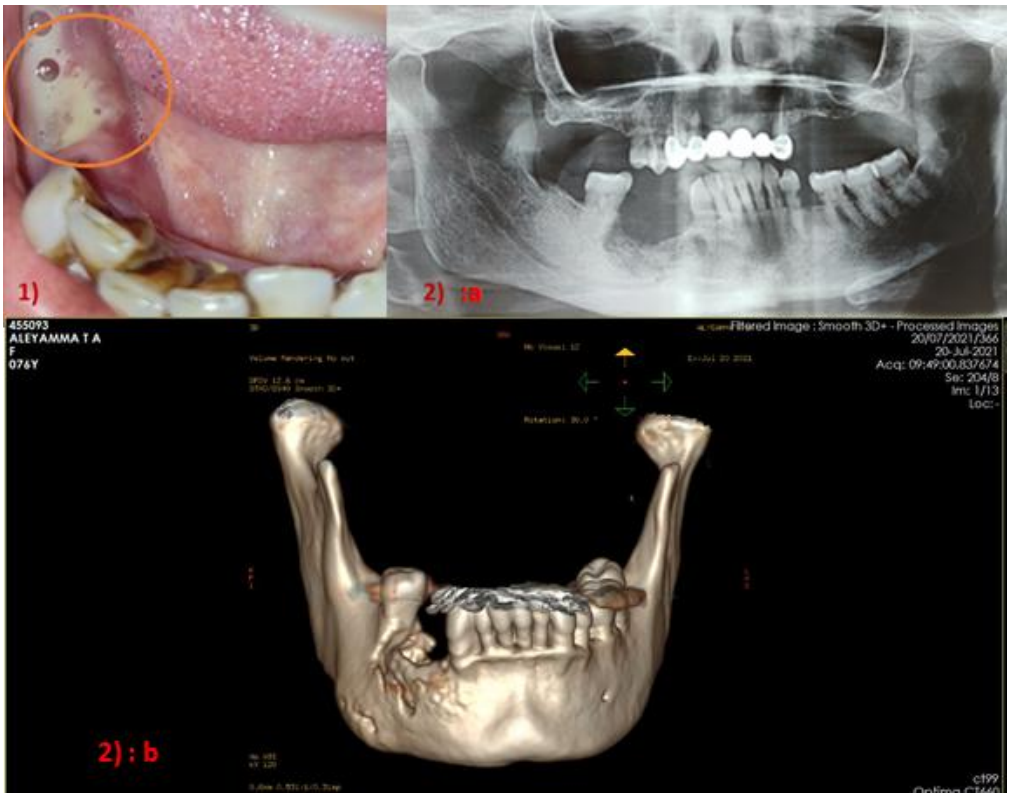


Fig. 1. Pus discharge from extraction socket, Fig. 2a. OPG one year extraction, Fig. 2b. 3D CT mandible

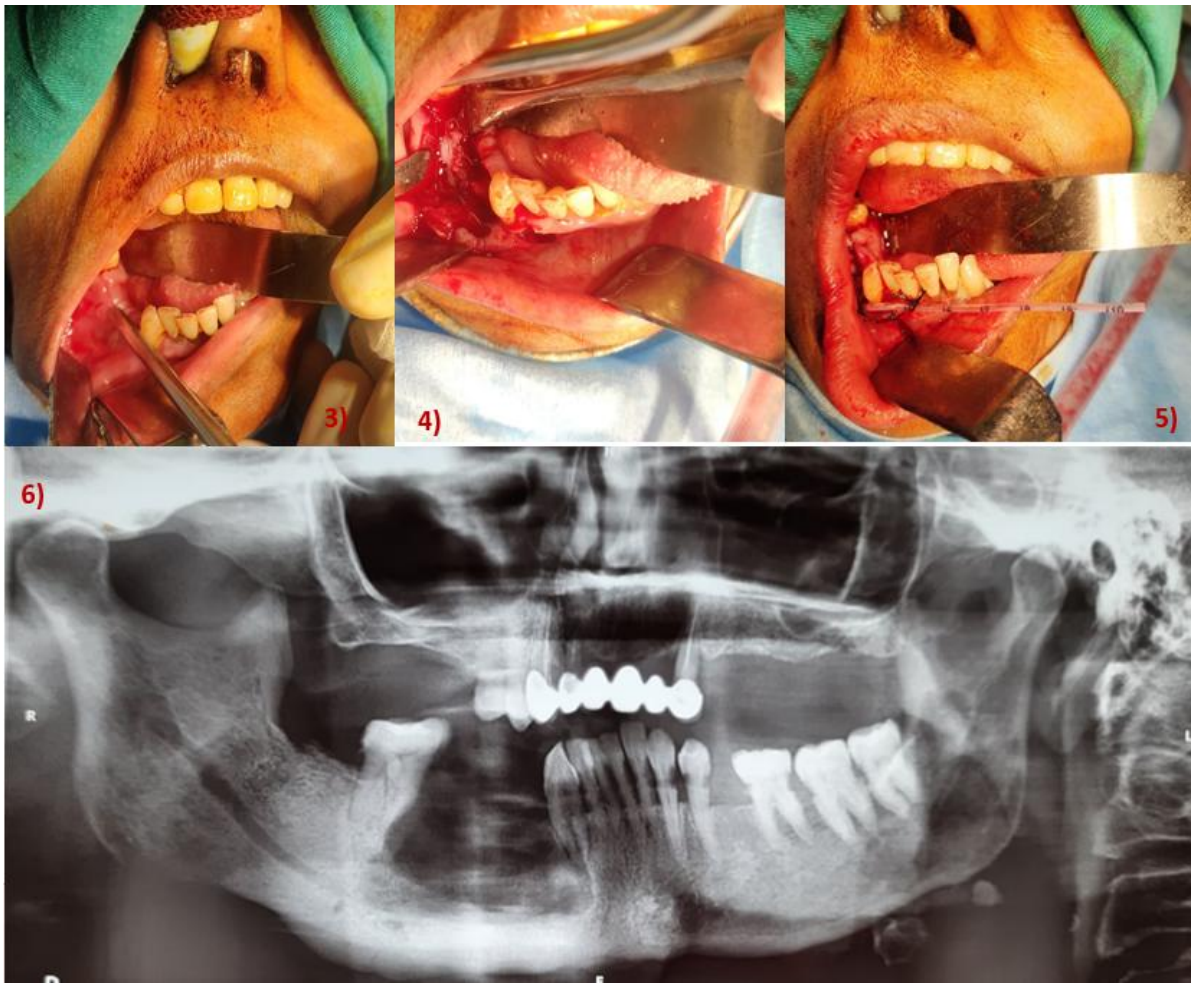


Fig. 3. Site at the time of surgery, Fig. 4. After sequestrectomy
Fig. 5. After suturing, Fig. 6. Post op OPG (A post - operative OPG was recommended instead of CT as the effective radiation dose of OPG is only 0.007mSv as compared to a CT- 8mSv)

The late and major complication of therapeutic radiotherapy for head and neck cancer is osteoradionecrosis. Osteoradionecrosis was considered an infection initiated by injury to irradiated bone before 20th century. Marx [4,5] has shown that it is a chronic, non-healing wound caused by hypoxia, hypocellularity and hypovascularity of irradiated tissue. Before 1960's only ortho voltage irradiation was the available treatment modality which was highly deleterious to bone and the incidence of ORN was about to be 37% [6]. But shift from orthovoltage to megavoltage, targeted irradiation, collimation, dose fractionation etc. reduced the incidence to 2 to 5 percent [7]. Initially ORN was thought to be a triad of radiation, trauma and infection. Marx et al. [8] have shown that microorganisms are merely contaminants and trauma is only one of several factors involved in the disease.

Irradiation in chest wall for breast cancer usually do not cause ORN mandible. But if a supraclavicular field of irradiation is done in such cases, this may cause ORN of mandible as the irradiated field is in proximity with mandible.

5.1 Incidence

ORN is common in mandible among facial bones which account about 2-3% [9,10]. The second common bone involved in ORN is temporal bone.

5.2 Classification

The following are the most accepted classification system of ORN.

Marx - 1983 [3]

Table 1.

Stage	Description
I	Exposed alveolar bone without pathologic fracture, which responds to hyperbaric oxygen therapy
II	Disease does not respond to HBOT, and requires sequestrectomy and saucerization
III	Full thickness bone damage or pathologic fracture, usually requires complete resection and reconstruction with free tissue

Notani et al. [11]

Table 2.

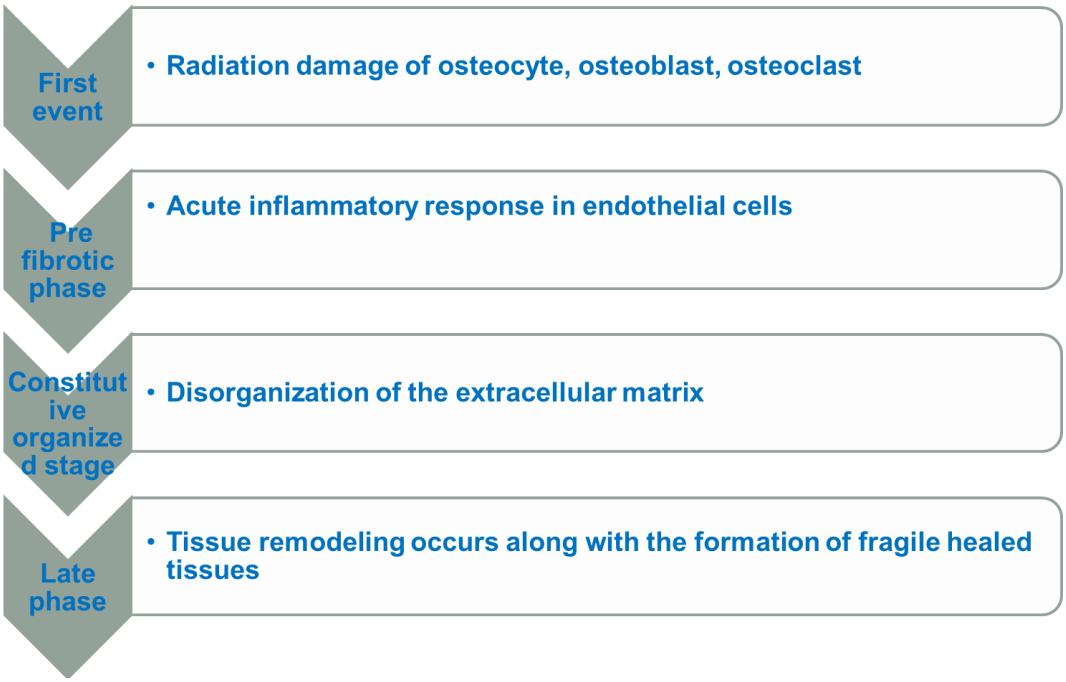
Stage	Description
I	ORN confined to alveolar bone
II	ORN limited to the alveolar bone and/or mandible aboce the level of the inferior alveolar canal
III	ORN involving the mandible below the level of the inferior alveolar canal and/or skin fistula and/or pathological fracture

5.3 Pathophysiology

Marx has described the three H principle in the development of ORN.

(i) Hypocellularity,
(ii) Hypovascularity of the irradiated tissues and
(iii) Hypoxia.

But now the fibroatrophic theory (2014) [12] is gaining much importance which states that fibroblast populations undergo total cellular depletion and reduced ability to produce and secrete collagen into the surrounding tissue in response to radiation exposure. The sequence in the development of ORN is given below:



Flow chart describing the fibroatrophic theory

5.4 Clinical Features

Severe deep boring pain with evidence of exposed bone are the chief presenting features. There may be associated trismus, fetid breath, pyrexia, soft tissue abscesses and persistently draining sinuses. Exposed bone is frequently associated with intraoral/extraoral fistulae. The exposed bone often has rough surface that abrades adjacent soft tissue and causes further discomfort.

5.5 Radiographic Features

Very little radiographic change occurs in the early stages of the disease. The characteristic changes seen in osteomyelitis of non-irradiated bone (sequestra and involucra) occur late or not at all in irradiated bone because of severely compromised blood supply. Initial blood flow assays with nuclear isotope technetium-99 methylene diphosphate scanning can be of some benefit in assessing regional perfusion of the afflicted areas.

5.6 Management

There is no universally accepted treatment for ORN. The management of ORN remains controversial, both radical and conservative treatments have been reported. Conservative treatment include systemic antibiotics, selective rinsing with topical antiseptics, and selective removal of small sequestra, curettage and local debridement. Radical treatment is indicated, where ORN is refractory to conservative treatment. Hyper baric oxygen therapy was once one of the mainstays of treatment. But now it's not included as a definitive treatment modality and is used only as an adjunct [13,14]. Circumscribed debridement can be performed in small necrotic areas, whereas large necrotic areas should be surgically removed [15]. All these procedures should be done as atraumatically as possible. Also the periosteum covering the intact bone should be preserved. Bone resection is performed, if there is persistent pain, infection or pathological fracture. It is preferably done intraorally, to avoid possibility of orocutaneous fistula in radiation-compromised skin. Studies have shown that combined use of pentoxifylline-tocopherol therapy has been effective in the management of septic ORN of the mandible. Because there is currently no standard medical treatment, this approach constitutes a useful alternative to existing therapies in treating ORN. The combinations of these two drugs act synergistically and are readily available, well tolerated and inexpensive [12]. Recently the use of PENTOCLO therapy is widely accepted which emphasizes on the combination of pentoxifilline-tocopherol-clodronate regimen [16]. However the use of clodronate is debatable as it may precipitate chemonecrosis / BRON J [17,18,19,20].

5.7 Prevention

Pre irradiation dental care of the teeth in direct beam of radiation should be performed. Non-restorable and periodontally compromised teeth should be extracted. Radiation therapy is delayed by 10 to 14 days to allow initial healing. Restoration of teeth, topical fluoride application and periodontal therapy should be completed before irradiation. If extraction is unavoidable after irradiation, the number should be limited to a minimum of one or two per appointment. Also extraction should be done atraumatically and without raising extensive flaps. It is mandatory to do extractions under antibiotic prophylaxis. Prophylactic use of pentoxifylline and tocopherol in such patients shows excellent results [21]. Time interval of extraction after irradiation has an important role in precipitation of ORN. As the time period increases chance of developing ORN also increases [21].

6. SUMMARY AND CONCLUSION

Chances of ORN of mandible are of rarest of a rare incidence in breast irradiation. In fact the risk of an RT-induced rib fracture following standard whole-breast RT is very low, with published series reporting rates between 0.3 to 1.8%, translating to 1–3 cases per 1,000 patients treated using modern RT techniques. So in a normal breast irradiated case we won't expect ORN of mandible. But this case report highlights the need of proper precautions that should be taken before extractions and other surgical procedures in mandible for who had undergone chest wall irradiation. Even though ORN of mandible secondary to chest wall irradiation not mentioned in the literature, it is not guaranteed.

CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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