

Osteoradionecrosis of the Jaw: A Didactic Insight

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ABSTRACT

Osteoradionecrosis is a distressing pathological condition which is commenced by the plethoric amount of radiation exposure. On exposure of the mandible to the profuse radiation, the blood supply of the jaw is compromised leading to a critical state of hypoxia. If left untreated due to untimely diagnosis, it may pilot to extravagant pain, deformities of the facial structures, possibilities of fracture and other complications. The core purpose of the article is to enlighten the possible risk and etiological factors along with pathological signs and symptoms associated with the disease. This would be an aid to the clinician to prevent, diagnose and treat the disease.

KEYWORDS: Osteoradionecrosis, Treatment, Pathophysiology, Mandible

INTRODUCTION

Currently, the treatment regimen for a person suffering from carcinoma of the head and neck region involves meticulous surgery, radiation followed by varied doses of chemotherapy. Hence, radiation proves to be a substantial source for therapeutic purposes and is a vital part of the remedy. Nevertheless, it has a potential to leave the patient vulnerable to possible side effects and coherent complications. Early and almost always certain side effect associated with therapeutic radiation doses involves oral mucosal inflammation.¹ It degrades patients comfort and quality of life exponentially. Late and more severe complications involve degraded taste buds leading to deteriorated taste sensation, xerostomia, lock-jaw, and few others including osteoradionecrosis. Reports have suggested osteoradionecrosis to be the most detrimental side effect analogous to the exposure with radiation.²

Even though radiation remains to be a sole reason for the occurrence of the osteoradionecrosis, a lot of risk factors and predisposing influences are responsible for it. Some of those compromise trauma, extraction of a tooth, poor immunity and degraded nutritional condition along with the dimensions of the tumor which was subjected to irradiation.³

The initial foundation of this pathology was elucidated by Regaud in the early 1920s.⁴ This was tailed by an explanation of the disease by Ewing in the late 1920s. He termed the pathological condition as the radiation osteitis.⁵ It was later classified to be part of osteomyelitis by Meyer.⁶ The coining of the terminology osteomyelitis of the irradiated bone was advocated by Titterington.⁷ The most precise explanation was dispensed by Mr. Max who described it as a bone lesion which is close to or higher than 1 cm in size in the range of x-ray radiation

which does not depict any form of healing for almost half a year.⁸

INCIDENCE

There is absolutely no clear mandate on the incidence rate of Osteoradionecrosis. However, the incidence has been enormous in patients with teeth as compared to edentulous patients.⁹ The main reason for this could perhaps be higher incidences of trauma during extraction. Reuther and his associates performed an enormous analysis based on a mammoth population of approximately 800 subjects. The entire study was carried out over a time span of thirty years which yielded that the percentage of incidence of osteoradionecrosis is over 8% when a person is continually exposed to the risk factors.¹⁰

LOCATION

The major location in the head and neck region which are susceptible to osteoradionecrosis involves the jaws. Time and again literature have shown that mandible is a common location owing to a lot of reasons. The foremost reason is the poor blood supply which renders it to a possibility of necrosis on injury or severe trauma. The other possible reason suggested is the constitution of the bone which happens to be very compact.¹¹

PATHOPHYSIOLOGY

One of the most recent explanations for the physiopathology of the osteoradionecrosis is the deleterious effects of the radiation on the bone which leads to severe variation in the blood supply.¹² However, these recent discoveries seemed to have impugned on the theory described by max which suggested hypoxia, lack

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of blood supply and disrupted cellularity as the prime reasons. Assael and his associates in the early years of 21st century mentioned that there could be several contrivances responsible for causing osteoradionecrosis, some of which includes reasons like the excess use of bisphosphonates as well significantly disrupted osteoclastic activity. Whenever any section of the bone is manifested to X-rays or any other pre-disposing factors, it causes over deposition of the bone leading to severe thickening. In usual cases, it is followed by a significant osteoclastic activity which would ensure that the thickened portion is resorbed and brought back to normal state. However, if the osteoclastic process is deranged owing to the deteriorated amount or impairment of the osteoclasts, it may lead to osteoradionecrosis. Some studies have always depicted the role of bacterial infection as a potential source for osteoradionecrosis.

The most novel concept suggests the fibro-atrophic mechanism caused by radiation to be a more precise mechanism. There is a preliminary phase which is referred to as the pre-fibrotic phase where there is a pre-eminence of the endothelial cells followed by inflammation. The next phase is characterized by a mammoth fibroblastic activity while the last phase is characterized by remodeling which is then disrupted due to re-activation of inflammation.

PREDISPOSING FACTORS

A lot of predisposing factors are associated with osteoradionecrosis. Some of them are as follows:

- **Radiation:** One of the most common factors responsible for causing osteoradionecrosis is the exposure to radiation. The incidence of the pathology is directly proportional to the amount of dose of radiation. High exposure over a short frame of time in a small area is the major culprit. However, ever since the availability of high-energy radiotherapy, a significant decline is seen in the incidence of osteoradionecrosis.
- **Trauma:** Trauma has been contemplated as a common predisposing factor for osteoradionecrosis. Trauma caused in any form including tooth extraction, surgical therapy and trauma from prosthesis could be complicit in leading to osteoradionecrosis.
- **Periodontal Condition:** When a tooth is exposed to radiation, it disrupts the periodontal fibers along with all the supporting structures which include alveolar bone and cementum as well. The fibers which are arranged in a specific manner get deranged followed by declined vascularity. This made also lead to significant accumulation of plaque and subsequent caries formation.
- **Tobacco Abuse:** Tobacco abuse has been clearly identified in the majority of patients suffering from osteoradionecrosis. However, an assured clarification of the mechanism of action has been established yet. Smoking tobacco may lead to vasoconstriction, playing a supplemental mode responsible for

constrained blood supply. These when combined with risk factors, may lead to osteoradionecrosis.

CLINICAL FEATURES

The expression of the pathological features varies greatly with the stage of the disease. At the preliminary juncture of the disease, pain and inflammation are the common findings. In the subsequent stages, soft tissue involvement is observed in the form of fistulas which is followed by exposure of the bone. The changes in the dermatological portion may include thinner skin as well changes in the color and texture of the affected area. Some cases have also reported the mucosal changes which involve dryness along with an ulcer at times. The bone might appear denuded with the involvement of a sequestrum. Other customary detections in the succeeding stages encompass pathological fractures as well as difficulty in opening of the mouth. The patient usually complains of trismus, oral halitosis, difficulty in swallowing and mastication.

TREATMENT MODALITIES

Treatment modalities for osteoradionecrosis could be divided into medical and surgical treatment.

- **Medical Treatment:** A medical treatment of a potential case of osteoradionecrosis starts with a preventive measure. Any person undergoing radiation in the head and neck region followed or preceded by a tooth extraction or any surgical trauma needs to have an assessment by the dentist. A dentist must recommend and perform oral prophylaxis, treatment of caries, scaling, and other usual procedures. It is recommended that the extraction should be considered a couple of weeks in advance of the radiation therapy. Also, post treatment, the patient should consider the use of fluoride and maintain optimum oral hygiene in order to decline the chances of occurrence of radiation caries.¹³ All most of the dental surgeons suggest that it is more acceptable to treat any case of osteoradionecrosis for as long as possible using medical therapeutics instead of surgical intervention. Pentoxifylline is a newer medicine which focuses on splurging the flexibility of the red blood cells with the help of an anti-necrosis factor. It plays an incredible role in limiting any form of inflammation and depletes the increase in shape, size and number of the cells. Tocopherol is another phenol compound which has shown promising results for the treatment of osteoradionecrosis. It plays an important role to act on the oxygen molecules, hence protecting the tissues against the peroxidation state.
- **Surgical Treatment:** Cases which may not respond well to medical therapies may be submitted to surgery. Hyperbaric Oxygen Therapy and surgical intervention are usually the part of the treatment regimen. Usually, most of the patients respond tremendously well to the Hyperbaric Oxygen Therapy. However, if the treatment doesn't work, it

is soon followed by sequestrectomy. If there is no improvement following this, consideration is given to perform sectioning of the mandible. The practice of Hyperbaric Oxygen Therapy has been advocated before the patient is subjected to X-ray radiation. However, the option has been questioned by a lot of clinicians owing to the fact that the treatment option is usually very expensive. Moreover, the patient usually has very low chances of developing osteoradionecrosis, especially if the oral hygiene of the patient is maintained and post radiation care is taken care of.

CONCLUSION

Osteoradionecrosis is a potentially lethal disease which has serious effects on human health leading to mortality as well as morbidity. It has numerous etiological factors and associated with it and hence it is highly imperative that a multi-stage treatment option is considered. Prevention of the disease with the appropriate advice of an oral surgeon is necessary. Novel research has suggested new approach strategies for treating osteoradionecrosis. A clinician should be fully aware of the new findings and must stay conscious regarding the detrimental effects of the disease thereby employing necessary steps to treat it appropriately.

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