

Osteoradionecrosis of the Mandible: A Case Report

SUMMARY

Osteoradionecrosis (ORN) of the jaws is a serious complication of radiotherapy of head and neck malignancies. Different assumptions about its occurring, risk factors and possible therapeutical modalities exist, but the clinical outcome of such patients is still not on the desired level. This article presents a clinical case of ORN of the mandible, occurring with exposed and infected bone, necrotic process that extended through all the mandible body, as well as cutaneous fistula. The first site of ORN was detected 2 years after radiotherapy for oral cancer, with the second one detected 3 and a half years after radiotherapy. In both, the reason for exposing the bone was local trauma due to tooth extraction. Due to the stage of the condition, a decision for surgical treatment accompanied with antibiotics was made.

It is very important and critical for irradiated patients and patients with osteoradionecrosis to perform appropriate oral hygiene and frequent dental checks. Establishing protocols for prevention and treatment, but involving some new strategies regarding to this condition, are strongly recommended.

Keywords: Osteoradionecrosis; Mandible; Radiotherapy

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CASE REPORT (CR)

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Introduction

Osteoradionecrosis (ORN) of the jaws is a serious complication of radiotherapy of head and neck malignancies. It is clinically defined as exposed and necrotic bone associated with ulcerated or necrotic surrounding soft tissue, which persists for more than 3 months in an area that had been previously irradiated (not caused by tumour recurrence)^{1,2}. The radiation dose between 60 and 72 Grays has an effect on the endothelial linings of the blood vessels, causing vasculitis and endarteritis, which lead to ischemia and hypoxia due to hypovascularity^{3,4}. Hypocellular and fibroatrophic component is suggested by some authors as well⁵. ORN occurs predominantly in the lower jaw, commonly in the buccal cortices of lateral site^{6,7}. The most important inducing factor is surgical trauma, commonly a dental extraction. Other trauma, mechanical injuries, poor dental status etc. can induce the necrosis as well¹⁻¹⁰. Sometimes, in less than 10%, ORN occurs spontaneously¹¹. Some systemic and chronic diseases (diabetes, cardiovascular

diseases) and bad habits (smoking, alcohol consuming) can worsen the condition^{6,9,10}. The wound that appear after the trauma is failing to heal, so tissue breakdown and necrosis occur.

The most common clinical signs and symptoms of ORN are: pain, swelling, bone exposing, secondary infection, fistula occurring and bone loss. If not treated, the condition usually worsens. Depending on clinical presentation, ORN can be classified in 3 classes (stages)¹²: First stage includes patients with ORN limited to dento-alveolar segment; second stage of ORN is limited to dento-alveolar bone or the mandible, not crossing the mandibular canal; third stage includes the most complicated cases in whom ORN involves the mandible above the mandibular canal or it is presented with pathological fracture or skin fistula.

The prevalence of ORN in those with cancer of the head and neck is around 7.4% after conventional radiotherapy, 5.1% after intensity-modulated radiotherapy (IMRT), and 6.8% after chemo-radiotherapy¹⁴.

There are number of studies that offer preventive protocols against ORN. It is suggested that all necessary tooth-extractions should be done 3 weeks before radiotherapy to prevent ORN⁸. Also, it is suggested that the risk of ORN is getting lower a year after radiotherapy. However, there are reported cases with ORN that occurred even after 10 years. Despite advances in the dosage and fractionation of radiation used to treat cancer of the head and neck, ORN remains difficult to manage¹³.

This article presents a patient with ORN that occurred 2 and 3.5 years after radiotherapy, in both sides of the mandible. Tooth extractions were the inducing factor. The ORN could be classified in the third class due to pathologic fracture and skin fistulas. The purpose of this case report was to review clinical characteristics of ORN, inducing and risk factors, options for management and, most important, the possible measures for preventing this condition.

Presentation of the Patient

This article presents a case of ORN of the mandible in a 54-year old male patient, treated in the Clinic for surgery of face, jaws and neck in Skopje. The disease occurred 2 times, in 2 different sites of the lower jaw. The patient was diagnosed with squamous cell carcinoma of the tongue, with an indication for surgical treatment. No systemic disease or chronic conditions were present. Necessary pre-operative tooth-extraction was done. Surgery was done 3 months after detecting the carcinoma. Because of the risk of occurring neck metastases, a neck dissection was done as well. The patient received 5 doses of radiation therapy in the Institute for Radiotherapy and Oncology in Skopje. Regarding the planned protocol, he received 1 dose that lasted 3 minutes, and 4 doses that lasted 2 minutes. Because of the metastatic findings, radiation was combined with 7-week-long chemotherapy, 1 dose per week.

2 years after radiotherapy, the patient showed up in the Clinic, complaining on bleeding and pain in the left area of the lower jaw, which started a week before his appointment. The clinical examination showed bone exposure and necrotic bone in the premolar and molar region. Residual radix of the previous extraction was detected. A diagnose of osteoradionecrosis due to mechanical trauma of residual radix was set. Panoramic X-ray showed radiolucency and sequestration which indicated lysis and necrosis of the bone. Conservative treatment with irrigation and local debridement was performed, but it was not successful. A surgical treatment was done, with removing the sequestra of necrotic bone (sequestrectomy). The outcome was good, with no signs of infection, but with exposed bone tissue (Figs. 1 and 4b).



Figure 1. Exposed bone tissue can be seen in the left mandibular area, 1.5 years after surgical treatment of the osteoradionecrosis. No signs of infection are present. A poor dental status can be noticed



Figure 2. The patient came again to the Clinic in January 2014. An asymmetry on the right side of the face in the mandibular area is seen, because of the swelling of the tissue



Figure 3. A cutaneous fistula is seen in the right mandibular area, indicating drainage of the purulent exudates from the inside

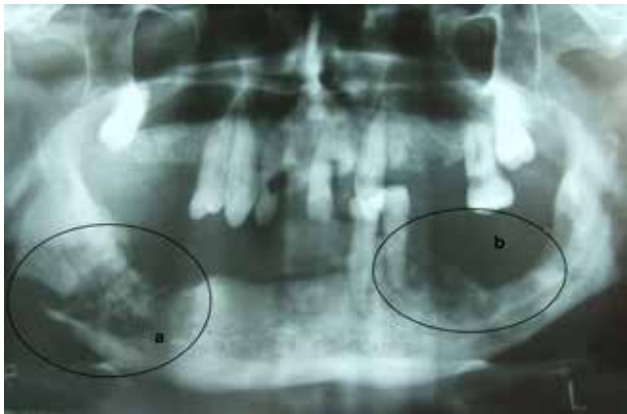


Figure 4. X-ray of the patient, January 2014. Extensive radiolucency and bone sequestration in right mandibular area that involve the mandibular canal and lower mandibular edge, with a pathological fracture can be seen (a). In the left mandibular area there are no signs of worsening of the previously diagnosed osteoradionecrosis in 2011 (b)



Figure 5. Intraoperative look of osteoradionecrosis in our patient. Necrotic bone tissue (arrows) can clearly be distinguished from the health tissue



Figure 6. Surgical removing of necrotic bone tissue

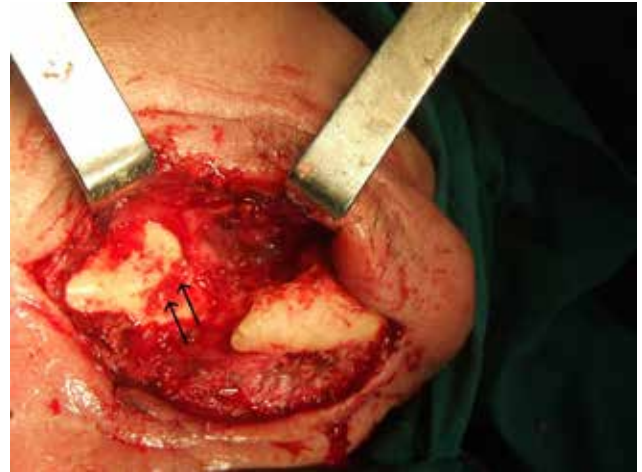


Figure 7. The whole necrotic bone tissue is removed. At the edges there can be seen blood vessels (arrows) indicating a good vascularisation of healthy bone

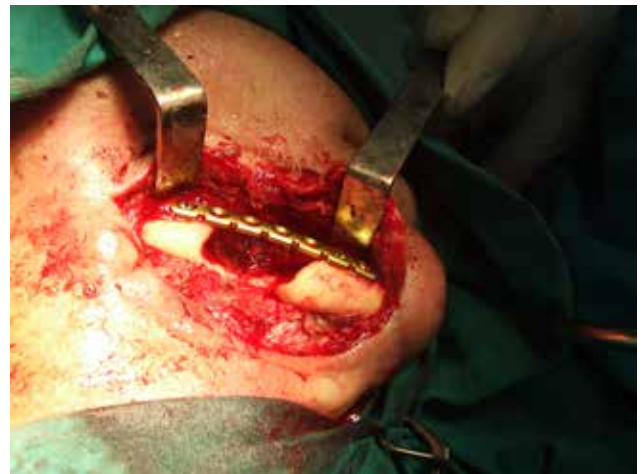


Figure 8. A metal lamina for fixation in situ

3.5 years after radiotherapy and 1.5 year after the firstly detected ORN, the patient came to the Clinic with signs and symptoms of pain, swelling, asymmetry and cutaneous fistula in the right area of the lower jaw (Figs. 2,3). Anamnestic investigation gave us evidence of extraction of the lower left molar by his personal dentist, a month before patient presented in the Clinic. He complained of pain, swelling with purulent exudate and inability of wound healing. Radiographic investigation showed extensive radiolucency and bone sequestration in the right mandibular area that involved the mandibular canal and lower mandibular edge, with a pathological fracture (Fig. 4a). The patient was again diagnosed with ORN; however, due to the seriousness of the condition, surgical treatment was indicated. Intraoperatively, necrotic bone tissue with no vascularisation was found (Fig. 5). Resection of the mandible followed by osteosynthesis with metal lamina was performed (Figs. 6-8). Fistulectomy was

done as well. Antibiotic of cephalosporin's third generation - ceftriaxone was administrated. The control check in March 2014 showed a good outcome, without exposed bone and any signs of infection.

Discussion

Osteoradionecrosis is a disease that needs great attention and a multidisciplinary collaboration, which involves the patient, general dentists, specialist in maxillofacial surgery and specialist in oncology and radiotherapy. Our case was diagnosed as a third class of ORN in the right mandibular area, which means that bone was extensively necrotic, causing a pathological fracture. In the both sites of the mandible ORN was induced by local trauma after tooth extraction. Although not mentioned earlier, the patient had a tooth extraction in the upper jaw as well, and it healed slowly, but successfully, with no evidence of necrotic bone. The mandible is common site for developing ORN because of its structure and vascularisation manner. Its density is much higher than that of the upper jaw. Consequently, it absorbs more photons during radiation, which leads to pathological vascular changes. It is the best explanation why the mandible is more susceptible to ORN than the maxilla. Once occurred, necrosis is getting worse with time if not treated. Microorganisms are not of the major role, but secondary infection is a common complication that leads to serious osteomyelitis.

If conservative treatment has not succeeded, a surgical approach is suggested. It is the only option in patients with late stage of ORN. The extension of surgical removing of bone tissue depends of the severity of necrosis. However, removing of all necrotic tissue is strongly recommended. The part of the bone that shows signs of bleeding and appropriate vascularisation points out healthy bone tissue (Fig. 7). A complete removing of the fistulous tract is recommended as well. If there is a huge bone loss after surgery, a reconstruction with some graft materials can be done. In our case, osteosynthesis with metal lamina (fixating plane) was done, without bone reconstruction.

Hyperbaric oxygen (HBO) treatment is also one of the strongly recommended treatment options for ORN¹⁵. As major pathogenic feature of ORN is hypovascularization and hypoxia, the HBO plays an important role in re-oxygenation of the tissue. A great number of literature data demonstrates benefits of HBO in the treatment of ORN. Most used manner of HBO treatment is the Marx's protocol, which means that the patient should receive HBO of 30 sessions before and 10 sessions after operation at 2.4 atm. for 90 minutes sessions. There are some modification in this protocol due to financial limitations and possible complications of HBO treatment.

This protocol is strongly recommended especially in patients with refractory and class 3 osteoradionecrosis. It can be used in prevention of developing ORN if tooth extraction is necessary.

Conservative, surgical and treatment with HBO often requires additional antibiotic treatment, especially when bacterial infection has occurred.

Recent studies have shown that incidence the ORN decreased to be lower than 5% and have attributed the phenomenon to the improved dental preventive care and improved radiation techniques, such as 3-dimensional conformal RT and IMRT¹⁶⁻¹⁸. The risk of developing ORN can be minimized by using IMRT, which unfortunately was not available for our patient. By using IMRT, only a small partial volume of the mandible is exposed to high radiation doses¹⁹.

Some systemic and chronic diseases and conditions can boost ORN. These risk factors include diabetes mellitus, cardiovascular disease and every condition that affects the immunological capacity of the patient. Smoking and frequent taking of alcoholic drinks highly favour developing of ORN²⁰⁻²². The patient we reported here showed no additional risk factors (systemic diseases or bad habits) except the combined chemotherapy, but a poor dental status was evident (Fig. 1). It is strongly recommended for all patients undergoing radiotherapy of head and neck malignancies to keep the teeth in good condition. If there is indication for extraction, it should be done before radiotherapy. Education and motivation of these patients to keep oral health as better as possible play a big role in preventing ORN.

PENTOCLO therapy is another proposed treatment modality. It is based on the concept of antioxidant and anti-fibrotic treatment of fibro-atrophy²³. The PENTOCLO combination is initiated to reduce the already constituted fibrotic process (pentoxifylline-vitamin E combination), reduce bone destruction (clodronate) and stimulate healing. Medical treatment by PENTOCLO appears to be an effective, inexpensive treatment that is almost devoid of adverse effects²⁴.

Surgical approaches such as small sequesters removal and debridement of superficial bone until bleeding occurs are regarded in many studies as conservative management. In advanced or refractory cases of ORN, surgical treatment, including microvascular reconstructive techniques for bone and soft tissue, remains the only option available²⁵.

Conclusion

This case report shows that it is very important and critical for irradiated patients and patients with osteoradionecrosis to perform appropriate oral hygiene and frequent dental checks. The additional risk factors,

such as local and systemic conditions, must also be controlled. If tooth extraction is indicated, prevention should be planned. Antibiotics and hyperbaric oxygen therapy are recommended prior to and after the extraction or operation, regarding to accepted protocols. Great attention should be pay to these patients several years after radiotherapy - our patient developed ORN 3.5 years after radiation treatment.

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