

# Systematization and classification of osteoradionecrosis of the lower jaw

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## Abstract

The osteoradionecrosis (ORN) is a severe, disabling complication caused by radiological exposure of vital bone in patients previously diagnosed with malignant tumors in the maxillofacial region. The treatment of osteoradionecrosis is defined for every clinical stage. The question about the prognosis and the prediction of progression is still open, although there is an adherence to the therapy protocols. The aim of the current review is to summarize the current literature data and to suggest a novel classification and staging system of the osteoradionecrosis. Accurate staging of the ORN is mandatory for the correct treatment plan and management, as well as for the prognosis and follow up. In spite of the great efforts, osteoradionecrosis stays one the most difficult conditions to overcome. It is possible to temporary stop the condition but the prognosis remains poor.

**Keywords:** *osteoradionecrosis, lower jaw, classification*

## Introduction

Osteoradionecrosis (ORN) of the jaws is one of the most serious complications of radiation therapy in head and neck cancer treatment, leading to bone death and impairing the normal function and lifestyle of the patients (1). Despite the improvement of the radiation therapy techniques and the reduction of the risk factors, the occurrence of ORN cannot be completely prevented (2). The current knowledge about the pathophysiology of the disease, as well as about the tissue response to the radiotherapy contributes to the introduction of promising methods for prevention and treatment (2,3,4). Studies demonstrate that ORN is a consequence of functional and structural interruptions of the bone, that may occur months or even years

after the completion of the radiation therapy (5). Well-known predisposing factors for ORN are the radiation absorbed, local trauma of the jaw, tooth extraction and the dental status of the patient (6,7,8). ORN may occur spontaneously with no history of additional risk factors (5).

The management of ORN is highly dependent on its stage (6,9,10). Several classification systems are suggested for this purpose.

ORN of the jaw bones is a late complication of radiation therapy in patients diagnosed with malignant tumors. It is defined as an area of exposed bone greater than 1 cm in irradiated region with no tendency of healing for a period of 6 months (9). In this type of necrosis, there is no interstitial infection, but only superficial contamination by bacteria (9). The most descriptive is the definition for ORN is slow-healing, radiation-induced ischemic bone necrosis, together with soft tissue necrosis, which is not associated with primary tumor growth progression, recurrence, or metastasis (11).

ORN can arise any time after the completion of the radio therapy, however in 70-94% of the cases it is observed within the first years (12). The first 2 years are the most critical for its occurrence, especially in radiation dose over 70 Gy and history of surgical procedure of the jaws (i.e. tooth extraction) (12). The management of ORN significantly depends on the progression and stage of the disease. Currently there are various classifications in the literature that facilitate the preparation of a treatment plan.

### Classification of ORN

Considering the classification of Clayman the type of necrosis is dependent on if the overlying mucosa is intact or interrupted. Therefore, type I necrosis is identified when the mucosa is found to be intact, while in type II ORN the mucosa is also found to be necrotic. The author suggested that type I could be managed via conservative methods, while type II requires surgical treatment (13).

#### Epsteins` staging/classification of ORN (6)

Stage:

I healed, resolved

Ia no pathologic fracture

Ib with pathologic fracture

II chronic persistent (nonprogressive)

IIa no pathologic fracture

IIb with pathologic fracture

III active progressive

IIIa no pathologic fracture

IIIb with pathologic fracture

Management:

follow-up is recommended

local management

Antiseptics, antibiotics, hyperbaric oxygenation

local management

Antiseptics, antibiotics, hyperbaric oxygenation

#### Classification/staging of Marx (7,9)

- First stage ORN: Primary ORN, exposed bone with no pathological fracture, responding to conservative treatment. Hyperbaric oxygen for 30 days is recommended

- Second stage ORN: If there is no response to hyperbaric oxygen for 30 days, debridement of the exposed bone is required. There is a need for surgical management, as well as additional hyperbaric oxygen for 10 days

- Third stage ORN: pathological fractures, fistulae and significant bone resorption are observed. Resection of the jaw is recommended in combination with hyperbaric oxygen (20 days preoperatively and 10 days postoperatively)

This protocol has been applied to 286 patients who have been successfully treated (7,9).

#### **Classification of Kagan & Schwartz (8)**

- First stage: soft tissue ulceration (ulceration of the gingiva) and necrosis of the cortical plate of the jawbone. Conservative management is sufficient

- Second stage: necrosis of the cortical plate and part of the cancellous bone; in 2a stage a small ulceration of the mucosa is observed, while in 2b there is soft tissue necrosis, as well as cutaneous fistulae

- Third stage: all parts of the bone are involved

#### **Classification of Notani (10)**

I Necrotic lesion limited in the alveolar ridge of the mandible

II Necrotic lesion of the mandible above the mandibular canal

III Necrotic lesion of the mandible involving the bone below the level of the mandibular canal, and/or oro-cutaneous fistula, and/or pathological fracture

#### **Classification of Store & Boysen (14)**

0- Mucosal defect

1- Radiological findings for necrotic bone with intact mucosa

2- Radiological findings for necrosis with bone exposure intraorally

3- Radiological findings for necrosis with exposed bone intraorally, cutaneous fistulae, infection

#### **Classification of Glanzmann & Gratz (15)**

1- Bone exposure without signs of infection, persisting for at least 3 months

2- Bone exposure with signs of infection and/or sequestrum

3- Necrosis, managed via resection with satisfactory clinical outcomes

4- necrosis with persistent symptoms and complaints following resection of the bone

5- death

To assess the complications of radiotherapy, several scales have been proposed, with functional indicators included. The scales demonstrate the effectiveness of treatment, quality of life and serve to prevent or reduce complications (16,17).

#### **Scale of NCI-CTC (16,17)**

1.Asymptomatic osteolytic lesions, identified radiologically. Treatment is not recommended, only observation

2.Moderate manifestation of symptoms affecting function, but without limitation of the patient's activity (Activities of Daily Living (ADL)): food preparation, shopping, telephone handling. Requires minimal, non-invasive, conservative treatment

3.Severe symptoms affecting normal activity. Hospitalization and aggressive treatment are indicated

4.Irreversible functional disorders, life-threatening. Requires maximum intervention

## Conclusion

There are wide number of methods in the literature for classifying ORN of the jaw bones. A number of authors have suggested staging scales in order to support the symptomatic treatment. The most popular and broadly used are the classification systems of Marx and Kagan & Schwartz, as well as the NCI-CTC Cancer Complications Rating Scale, with functional indicators included.

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