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Diagnosis of osteonecrosis of the jaw in patients with multiple myeloma

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Abstract

The aim of our study was to investigate the efficacy and informativeness of radiational diagnostic osteonecrosis of jaw in patients with multiple myeloma (MM) receiving bisphosphonates (BPH) therapy based on the use routine X-ray examination, orthopantomography and spiral computed tomography jaws. We have examined 53 patients with MM, which along with courses of chemotherapy were treated with BPH. The proposed diagnostic algorithm will help improve efficiency and decrease the cost of diagnosis and reduce excessive radiation exposure to the pat.

Keywords: multiple myeloma, osteonecrosis, X-ray, spiral computed tomography

1. Introduction

One of the severe disabling complications of multiple myeloma (MM) is the affection of skeleton. The most effective drugs used along with chemotherapy to treat bone destruction are bisphosphonates (BPH). Potential complications of BPH treatment is osteonecrosis of the jaw. This term means destructive lesions of one or both jaws, which remains over 8 weeks, with no previous exposure or metastatic lesions of this area [1-4]. The first time the of lesions appearance in the treatment by BPH described R. Marx ra D. Stern in 2002 [5]. Statistical data on the spread of this complication contradictory. According to the modern literature the prevalence ranges from 1 to 11% [6, 7]. An important role in the pathogenesis of appearance osteonecrosis of the jaw play a number of mechanisms: it's reducing the blood supply of bone, necrosis of bone cells and their apoptosis, the presence of untreated infectious lesions in the mouth, reducing the overall reactivity, old age, immunodeficiency, the appearance of such threatening complications are predictable. The study also showed that the provoking factors of osteonecrosis of the jaw in such patients is the extraction of teeth, the presence of dentures, implants, periodontal disease [8]. It is believed that a strong inhibition of osteoclast function by BPH leads to a reduction bone resorption, inhibits normal bone remodeling and metabolism, which leads to the accumulation of small micro damage and reduce the mechanical properties of bone [8]. Due to severity of this complication is urgency the issue of its early and effective diagnosis. To assess the state of the jaw in patients with MM receiving long-term treatment BPH can be applied by different methods of radiation diagnosis: bone scintigraphy, positron emission tomography (PET), magnetic resonance imaging (MRI), spiral computed tomography (SCT), orthopantomography (OPT), X-ray examination [2]. More accessible methods of radiation diagnosis is OPT and CT. Orthopantomography saves time and demonstrates the entire mouth in one image. A more accurate method of diagnosis of osteonecrosis of the jaw, according to many authors, is SCT [1]. Despite the today quite effective methods of osteonecrosis recognition, there are no clear recommendations for diagnostic algorithm destruction of the jaw in patients with MM receiving prolonged treatment with BPH. Resolving this issue would help increase the efficiency, reduce the cost of diagnosis and reduce excessive radiation exposure to the patient.

The aim of our study was to investigate the efficacy and informativeness of radiational diagnostic osteonecrosis of jaw in patients with MM receiving BPH therapy based on the use routine X-ray examination, orthopantomography and spiral computed tomography jaws.

Material and methods. To solve this goal, we have examined 53 patients with MM, which along with courses of chemotherapy were treated with BPH. The average age of patients was $65 \pm 3,4$ years. Age fluctuations amounted to 45-82 years. Among examined was 31 women (58.5%) and 22 men (41.5%). The average duration of therapy BPH ranged from 6 to 57

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months. Along with clinical and laboratory methods of examination of patients with MM for the study of jaw bone changes during BPH therapy applied the following methods of inspection X-ray radiography, orthopantomography, spiral computed tomography (SCT). All patients inspected dentist.

Results and discussion. When viewed dentist found that in only 8 patients (15.1%) the state of oral assessed as satisfactory. The rest of the patients (84.9%) observed certain abnormalities - partial or complete absence of teeth, caries, periodontal disease, oral mucosa pathology and others. The presence of dentures was found in 36 patients (67.9%). Toothache and pain in the jaw bones of varying severity observed in 14 patients (26.4%). Implantation in history was held 4 patients (7.5%) of the inspected group. In no case was diagnosed open bone defects of the jaw, revealing a heavy degree of osteonecrosis. OPT is not able to adequately visualize the difference between osteonecrosis and osteoblastic metastatic lesions, but can qualitatively demonstrate osteosclerosis and osteolysis. OPT detects bone formation consisting of periosteal thickening and fibrosis of the bone marrow that manifests increasing bone density. The progression of osteonecrosis appears the formation of cavities and sequestration. OPT downside is the two-dimensional image. In addition, the image quality may complicate the differentiation of zone between necrotic and healthy tissue, thus, can be overlooked early signs of damage. Spiral CT showed itself as a more accurate method of diagnosis of the lesion. The method accurately detects changes in bone, periosteal reaction and soft tissue changes. CT avoids the image distortion, such as seen in OPT and provides excellent tomographic anatomical illustrations of organ structure and their pathological changes. CT capabilities allow to distinguish areas of osteosclerosis and osteonecrosis, visualize regions of pus and swelling of soft tissues. Examination of jaw bone using OPT allowed to reveal effects of osteonecrosis of the mandible varying severity in 9 patients (17%). The secondary destructive lesions of the upper jaw were not found. All patients OPT held together with spiral CT jaw bone.

Results of the study showed that in 46 patients (86.8%) significant difference in bone changes upper and lower jaws revealed by methods OPT and spiral CT was not. Sensitivity did not differ significantly. However, spiral CT allowed to visualize different degree of manifestation of osteonecrosis in 10 of the patients (18.9%).

In 2 patients (3.8%) during the examination by OPT we found changes in bone structure, are not detected by CT - study.

In 5 cases, spiral CT showed higher diagnostic sensitivity compared with OPT and allowed to visualize changes in the bones of the jaw, which was not visible radiographically.

Founded by us the jaw bone changes with methods OPT and spiral CT were not systematic. Do not also reveal a clear link with clinical manifestations of osteonecrosis. This is due, probably a small number of patients in our study, as well as according to research other authors.

2. Conclusions

So, the results of our investigation showed that the sensitivity OPT and spiral CT did not significantly differ. Orthopantomography enables us to identify areas of osteosclerosis and osteonecrosis, their localization and volume, bone structure, damage of alveolar bone and the whole jaw. Spiral CT allows to detail pathological process, shows the status of locking plates, clarifies the volume of

pathological lesions.

Based on the results we have proposed algorithm of appointment ray diagnostic methods osteonecrosis of jaw bones in patients with MM receiving treatment with BF:

1. All patients receiving long-term therapy with bisphosphonates should be diagnostic OPT at least 1 time per year for early detection of phenomena osteonecrosis of jaw bones and its treatment.
2. If necessary, detail of process and the presence of clinical indications (presence of large foci of osteonecrosis involving violation of the integrity of bones and mucous membranes, jaw function, pain, soft tissue lesions) and in case of the need for surgical treatment - indicated holding spiral CT).

The proposed algorithm will help improve efficiency and decrease the cost of diagnosis and reduce excessive radiation exposure to the patient.

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