"Radiodiagnosis of traumatic osteomyelitis in the maxillofacial region."

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Aims and objectives

Objective: to improve radiodiagnosis of traumatic osteomyelitis in the maxillofacial region.

Methods and materials

42 patients aged 18-50 with traumatic osteomyelitis in the acute, subacute and chronic phases of inflammatory process were under study.

The general and local statuses were defined in all the patients as well as for all of them were made othopantomograms using STRATO 2000 D (Villa Sistemi Medicali, Italy). To specify the disorders of the bones and the surrounding tissues in the complicated anatomic areas we made MSCT using Brilliance 64 (Philips, Holland) in 51% of patients and dental volumetric tomography using the cone-beam tomograph i-CAT (Imaging Sciences International Inc., USA) in 48% of cases. To find some liquid accumulation, analyze the soft tissue structure and blood flow in 36% of cases we made US diagnosis using the US scanner Philips AU-22 (Philips, Holland) with convex and liner sensors (2,5-8 #Hz).

Among the patients with traumatic aetiology of the inflammatory process we came across the following traumas: street - 50 %, transport- 2%, household-2%. The rest 46% of the cases were those after complicated extraction of the third molars on the lower jaw.

The double fracture of the lower jaw (58 %) in the area of force trauma and the places linked with it - was the most often case which we studied. In this area we usually examined splintered compound fractures with an irregular line. Dislocation of the fragments depended on the pull of muscles and the direction of the traumatic force (Fig.1).
**Fig. 1:** Multislice computer tomography of a patient with double fracture of the lower jaw: # - 3D reconstruction (the arrows show the fracture lines); # - skew-sagittal reconstruction (the fracture line goes through the cavity of the 35th tooth, the mandibular canal and the mental aperture).

**References:** Radiology Department, Moscow State University of Medicine and Dentistry - Moscow/RU

**Images for this section:**

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Results

The objective examination of the patients in the acute phase of osteomyelitis showed some abnormalities in face configuration at the expense of infiltrative changes, injuries with sanious, serous and purulent discharge, pain while examining by touch and limited mouth opening. X-ray methods at this stage were uninformative. The orthopantomograms showed only the signs of fracture and bone fragments more than 5 mm while MSCT and CBCT defined additionally small fragments (up to 1 mm), an increased volume of soft tissues and some changes in the front part which it was difficult to find on the orthopantomograms (Fig. 2).

![Orthopantomogram](image)

**Fig. 2:** Orthopantomogram of a patient with the fracture of the front part of the lower jaw. The diagnosis of the disorders of the front part of the lower jaw is difficult because of shade overlapping in the projection of the vertebral column.

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To specify the changes in soft tissues the patients were made US which helped to define areas of diffusive inflammatory infiltration characterized by the presence of:

- some zone of decreased echogenicity without clear borders, heterogeneous structure (Fig. 3);
- single signals of low intensity in the areas of inflammatory infiltration showed by dopplerography, at the same time the blood flow was not detected at all;
- thickenings at the expense of lymphedema of the skin and subcutaneous fat, illegibility of the derma border;
• a decrease of the echogenicity of muscular tissue at the expense of edema. The US picture was blurred.

**Fig. 3:** US of soft tissues of the right parotideomasseteric region of a patient with traumatic osteomyelitis. B-regime. The area of lower echogenicity with irregular, vague borders, heterogenic echostructure and small hyperechogenic insertions is visualized.

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The subacute phase of the inflammatory process was characterized by a decrease of clinical symptoms and here we saw radiopositive changes in the front line. All the tomograms showed irregular and vague edges of bone fragments with the signs of osteoporosis, periosteal formations and bone sequesters in their initial stage. The tomograms (MSCT and CBCT) visualized periosteal formations both on the lower edge of the mandible and the vestibular and oral surfaces as well as some sequesters (1-3 mm) located in the thickness of bone tissue - it was really hard to identify all of them on orthopantomograms. We managed to study the link of sequestral cavities with the surrounding tissues (maxillary sinuses, mandibular nerve canal and etc.) US allowed us to examine the extent to which the edema of soft tissues was spread, presence of
periosteal reaction (excluding assimilated osseous periostitis) of the rejected or located close to the surface sequesters (Fig. 4).

Fig. 4: Multislice tomogram of the patient with traumatic osteomyelitis: A - sequesters less than 3 mm in size, B - line periostitis on vestibular cortical plate.

References: Radiology Department, Moscow State University of Medicine and Dentistry - Moscow/RU

In case of osteomyelitis after complicated extraction of the third molar on the lower jaw the tomograms showed holes with irregular borders without signs of reparation, dense shades in the area of the hole and some disorders of the walls of the mandibular canal. But in the first case we found out a fragment of a dental instrument in the position more distal from the hole in the mandibular canal projection (Fig. 5).
**Fig. 5:** CBCT of the patient G. with complicated extraction of the impacted and dystrophic 48th tooth in the past history (4 weeks ago). Multiplanar reconstructions: #- axial, # - skew-sagittal. In the cavity there are multiple dotty insertions of bone thickness (sequesters) and filling material (3,9 # 1,5 mm). At the level of the cavity bottom we see a fragment of a dental instrument penetrating the mandibular canal and destroying its upper wall.
The patients in the chronic phase of osteomyelitis complained about purulent discharge from the sinus tracts and post operational injuries, bone tissue exposure and fragments mobility. The tomograms showed a decrease of destruction zones, osteosclerosis and an increase of bone volume at the expense of assimilated periostitis (Fig. 6).
Fig. 6: CBCT of the patient K. with fracture of the lower jaw in the area of the tooth 3.6 - the result of a street trauma sustained 5 months ago. Multiplanar reconstruction: #-axial, B - frontal. It shows the fracture line at the level of the extracted tooth 3.6, - going through the mandibular canal. The borders of the bone fragments are sclerosized and irregular. The oral cortical lamina shows periostial reaction, the thickness is 1,5 mm. We see small fragments (1,0 mm) in the fracture plane.

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Using MSCT we additionally examined the changes of the surrounding soft tissues: a decrease of differentiation and thickening because of infiltration, purulent cavity and sinus tract formation, an increase of regional lymphatic knots that is usually a preventing point for making DOT (diffuse optical tomography) as visualization of soft tissues is decreased in comparison with MSCT.

To make a more precise diagnosis of soft tissues the patients were made US which helped to define disorders of the vestibular cortical layer of the lower jaw, areas of cicatrical and fat degeneration of soft tissues and focuses of inflammation visualized on the sonograms and characterized by liquid regions with irregular and vague borders inside of which the blood flow was not detected, but hypoechogenic insertions were on the contrary found out. The differentiation of soft tissues was abnormal around the inflammatory focus and along the focus periphery the vascular pattern was more intensive (Fig. 7).
**Fig. 7**: Us of soft tissues of the left jaw region of a patient with chronic traumatic osteomyelitis resulted from a street trauma. A- B-regime: in the projection of the teeth 3.7-3.8 we see a hyperechogenic insertion of 1,2-0,2 cm with clear irregular borders and an acoustic shade (sequester). B - Doppler regime: vascularization intensity of soft tissues along the periphery of the sequestral cavity.

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MSCT picture of limited inflammatory cavity was characterized by a number of specific features:

- the focuses of inflammation had lower density (+ 25 ± 16 #U), its border was regular enough but vague in some places;
- the surrounding soft tissues in the area of isolated inflammatory process looked edematic and mis-shapen;
- in 23% of cases we found out sinus tracts with gas bubbles at the background of infiltration (the configuration of the bubbles and topographoanatomic relations were defined with high extent of reliability in case of CT fistulography) (F9g. 8).
Fig. 8: MSCT of the patient H. with double fracture of the lower jaw, multiplanar reconstructions. Before the injection of contrast substance the tomograms (A, B) show the lines of lucency at the level of the missing teeth 3.4 # 3.8 while the signs of consolidation of the fragments are not detected. Making CT fistulography (C, D) we injected the contrast substance (6,0 ml, Omnipak) through the sinus tract opening to the patient's skin to the left of the lower jaw in its angle projection. The contrast substance fills densely the pathologic cavity of 8,7#28,6 mm, located in the soft tissues of the left buccal region and connected with the above-mentioned fracture line at the level of the missing tooth 3.6.

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**Fig. 7:** Us of soft tissues of the left jaw region of a patient with chronic traumatic osteomyelitis resulted from a street trauma. A - B-regime: in the projection of the teeth 3.7-3.8 we see a hyperechogenic insertion of 1,2-0,2 cm with clear irregular borders and an acoustic shade (sequester). B - Doppler regime: vascularization intensity of soft tissues along the periphery of the sequestral cavity.

![Fig. 7](image)

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Conclusion

Diagnosis of traumatic osteomyelitis in the maxillofacial region should be made according to an expected disease phase and include not only traditional methods but those high-tech: CBCT, MSCT and US. For acute osteomyelitis the most informative data may be those of clinical examination while US can define for sure changes in soft tissues. For the subacute and chronic phases it is more advisable to apply orthopantomography and additional methods of CBCT, US and MSCT including CT fistulography in case of indications.

Personal information

References