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*Imaging diagnostics approach to tumours of ramus
and angle of the mandible*

As the development of up to date diagnostic equipment continues, the conventional roentgenodiagnostics keeps drawing back. It is presumed that the new methods of diagnostic imaging will be in the lead before long as even now they unite the advantages of morphological and functional examinations. It must be underlined that these methods, such as MR imaging and diagnostic ultrasound, allow for the reduction of diagnostic risk due to extensive elimination of the X-rays. This fact is fundamental especially in investigations of neoplastic diseases of the complex anatomical structures of the maxillofacial region. The choice of treatment strategy depends closely on the results of diagnostic examinations. Computed tomography (CT) and magnetic resonance imaging (MRI) allow for prior planning of a surgery just as it is in the case of malignant neoplasms. Computed tomography three-dimensional reconstructions (3D CT) facilitate preparation and preliminary adjustment of tissue grafts to the postoperative bone defects.

However, it would be untrue to assume that the standard radiological examination techniques are no longer necessary. It must be remembered that they are cost-effective and as the conventional radiography equipment is common it justifies the continued use of it, at times as the only source of information in the field of radiology, every so often as the initial selection of patients. The abundance of diagnostic imaging techniques makes it indispensable to reconsider diagnostic approach to many maxillofacial disorders, including mandibular tumours, and to elaborate algorithms of radiological examinations allowing for the planning of a cost-effective treatment based on thorough diagnostics.

MATERIAL AND METHODS

The material was composed of analysis of 146 case records of 68 patients examined in the years 1995-2000 in the Department of Dental and Maxillofacial Radiology and the 2nd Department of Medical Radiology of Medical University of Lublin. There were selected radiograms as well as the results of other imaging modalities of persons with clinically confirmed neoplasms of mandibular ramus or angle. In each case there were noted: the initial and the final diagnosis as well as the number and sequence of the performed diagnostic examinations. The analysed X-rays were taken according to conventional rules of radiography. Ultrasound examinations were performed using the Hitachi

EUB-410 equipment with a linear probe with a standoff gel pad allowing for elimination of near field artefacts. The computed tomography scanner used was the Siemens Somatom AR-T apparatus equipped with a high contrast and spatial resolution matrix comprising 512 x 512 pixels.

RESULTS

The best evaluation of the structure of the mandibular bone in cases of ramus and angle neoplasms was supplied by a panoramic picture (Fig. 1).

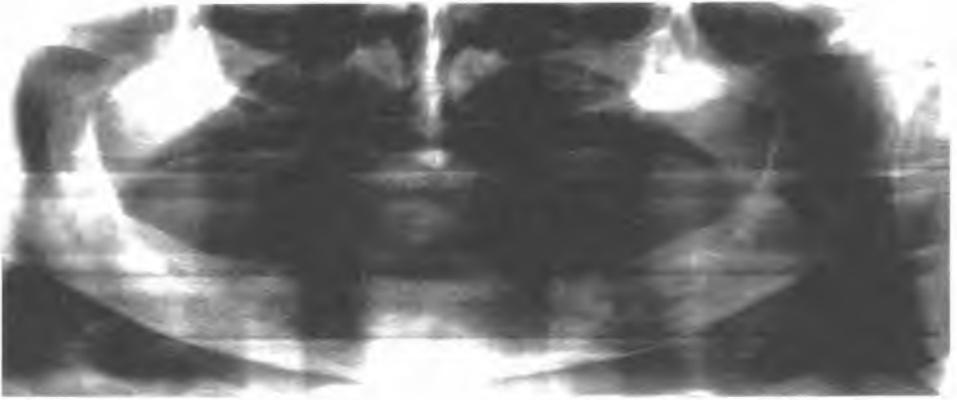


Fig. 1. Panoramic X-ray in case of mandibular neoplasm shows a bone defect in the region of left angle and body of the mandible



Fig. 2. True oblique lateral view of the same patient well presents the area of bone destruction

In the centers that do not possess suitable equipment the combination of two views: PA and lateral radiogram of the maxillofacial region was considered a substitute. The diagnostics continued with an oblique lateral radiogram of the mandible that gave a good evaluation of bone destruction in the region of the mandibular angle and ramus (Fig. 2).



Fig. 3. Coronal CT scan in soft tissue window shows infiltrating masses as well as the destruction of the mandible



Fig. 4. Ultrasound examination of the submandibular region – well visible tumour masses of mixed echogenicity

Intraoral dental X-rays supplemented the diagnosis and allowed for full evaluation of the resorption or displacement of roots of teeth located in the vicinity of the expansive and infiltrating tumour. The computed tomography examination not only demonstrated the extent of the soft-tissue tumour but it was also a very sensitive method of detection of destruction of mandibular bone as well as possible periosteal reactions and pathological fractures (Fig. 3).

Ultrasonography played a less important role but it facilitated the evaluation of regional lymph nodes and in the cases of exophytic tumours it allowed for direct visualizations of neoplastic masses destroying the cortical layer of mandibular bone and growing into the soft tissues of face (Fig. 4).

The frequency of the above mentioned diagnostic imaging was presented in Figure 5. Due to the selection criteria of the presented study, all the patients had the CT examination.

On the basis of the obtained results the diagnostic algorithm in case of tumours of the mandibular angle and ramus was proposed and presented in Figure 6.

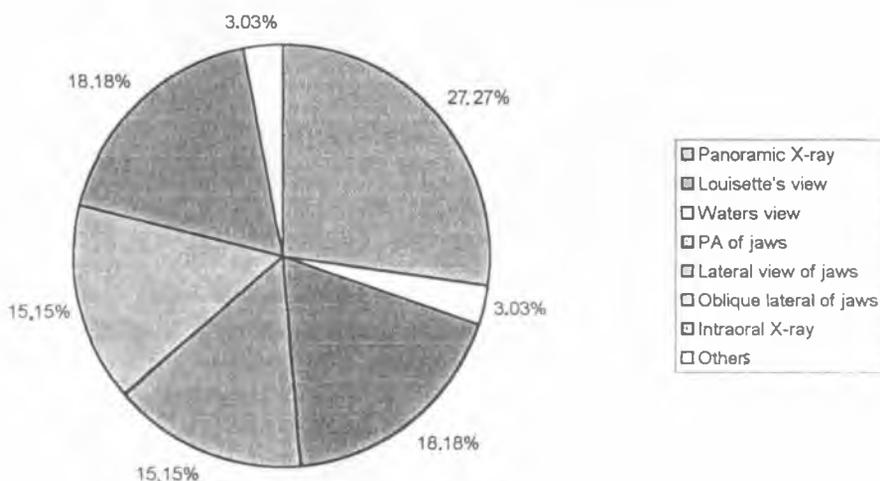


Fig. 5. Conventional radiograms taken in patients with tumours of the mandibular angle and ramus

DISCUSSION

Radiological visualization of the maxillofacial region is undoubtedly challenging as the anatomical structures composing this area are very complex. Moreover, numerous diseases affect this region – almost all the disorders occurring in other parts of the human body and additionally several pathologies that are encountered only in the maxillofacial area (5).

It is the panoramic X-rays, intraoral radiograms as well as true oblique lateral views that play the fundamental role in the diagnostics of osteolytic changes of the mandibular angle and ramus (1, 4, 7, 8, 9) that was confirmed by the results of the presented study.

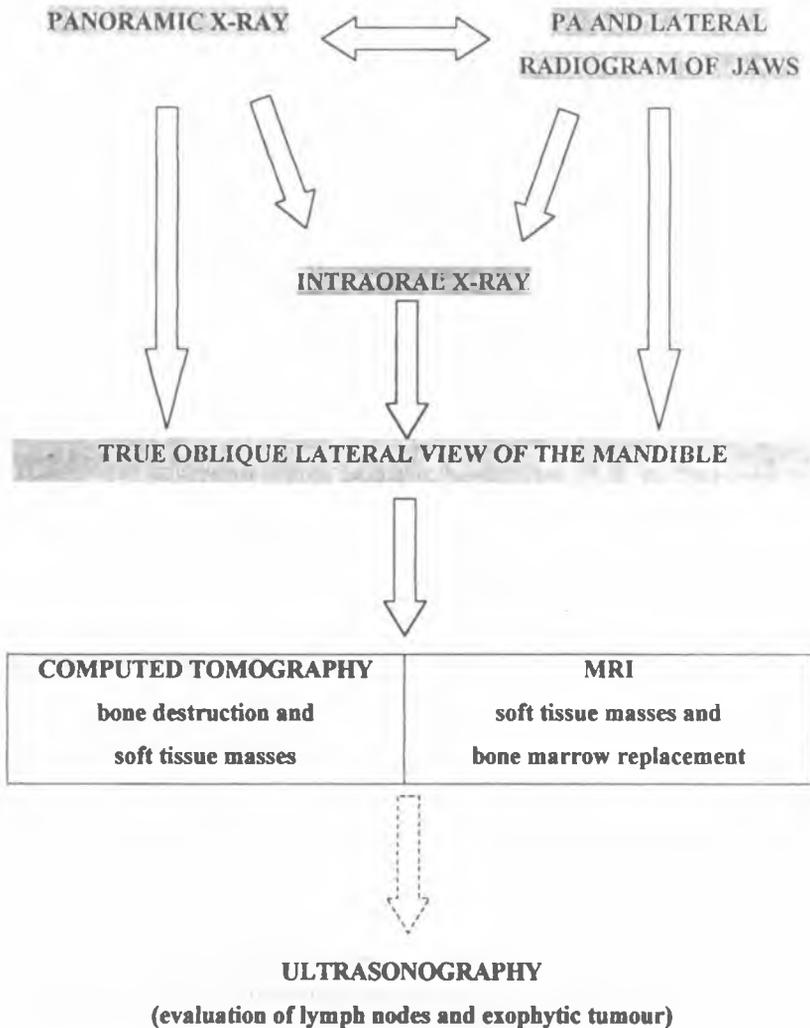


Fig. 6. Diagnostic algorithm in tumours of the mandibular angle or ramus

Thin-needle aspiration biopsy of neoplasms causing focal bone destruction sometimes is non-contributing due to very dense character of the tissues of the lesion. In order to present well the consistency of pathological areas L a u r i a et al. (3) performed ultrasound examinations in cases of osteolytic or mixed changes. The areas of bone remodelling, which formed a radiopaque mass on radiograms, were excluded from the studies. The increased echogenicity was observed in cases of dentigenous tumours. Anechoic areas were characteristic of odontogenic keratocysts due to their dense content (keratine). Mixed echogenicity characterised dental as well as other pathologies in which there were present not only tissues but

liquids as well (3). Diagnostic difficulties were caused by infected cysts as their contents become echogenic and there appear even tissue masses but with cystic areas. The final diagnosis is not possible on the basis of the ultrasound examination, however, it allows for initial differentiation of liquid and solid masses. As a non-invasive and relatively cheap method it is a complementary examination in the diagnostics of pathologies in the maxilla and mandible (5, 7).

Computed tomography well presents the extension of the lesion as well as the influence on the normal structures in the form of bone destruction or root resorption and displacement that was confirmed by own results (4, 7). To a certain extent it enables differentiation of benign and malignant changes due to the visualisation of margins of lesions as well as of good sensitivity in detection of bone destruction (1, 2).

Although MRI is not useful in imaging of bone tissue, as it has no signal in this technique (5, 7, 11), at the same time it is characterised by high sensitivity to the changes in bone marrow (6). As the bone marrow changes from red to fatty, the signal intensity on the T1-weighted spin echo sequences also changes from a low to high one (10). On the contrary, a pathological process that alters or replaces fatty marrow usually decreases the T1 signal intensity. Malignant tumours develop mainly in older persons in whom the bone marrow underwent fatty change and shows high signal intensity on T1-weighted images (6). Therefore malignant neoplasms invading marrow display reduced signal intensity. On the other hand, T2 signal intensity depends on the type of tissue that replaces the fatty marrow. It has been reported that inflammatory processes, necrotic tissues and haematomas have a higher T2-signal than that of neoplastic tissue (11).

CONCLUSIONS

1. Possible variants of imaging modalities in tumours of mandibular ramus and angle were discussed and the most effective method was indicated.
2. The diagnostic algorithm in cases of mandibular angle and ramus tumours was elaborated.
3. It was proved that conventional radiograms are still fundamental in initial selection of patients while other diagnostic imaging methods are indispensable in treatment planning.

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SUMMARY

The abundance of up-to-date diagnostic equipment and imaging techniques makes it necessary to reconsider diagnostic approach to many maxillofacial disorders, including mandibular tumours, and to elaborate algorithms of radiological examinations allowing for the planning of a cost-effective treatment based on thorough diagnostics. The material was composed of 146 case records of 68 patients examined in the years 1995-2000 in the Medical University of Lublin. There were selected radiograms as well as the results of other imaging modalities of persons with clinically confirmed tumours of mandibular ramus or angle. In each case there were noted: the initial and the final diagnosis as well as the number and sequence of the performed diagnostic examinations. On the basis of the obtained results there was proposed a diagnostic algorithm in cases of mandibular angle and ramus tumours, which was presented in the form of a scheme. It was proved that conventional radiograms are still fundamental in initial selection of patients while other diagnostic imaging methods are indispensable in treatment planning.

Zastosowanie technik obrazowania diagnostycznego w przypadkach guzów trzonu i kąta żuchwy

Wielość dostępnych obecnie metod obrazowania diagnostycznego oraz ciągły rozwój sprzętu rentgenowskiego sprawiają, że należy ponownie rozważyć schematy postępowania diagnostycznego w przypadkach wielu schorzeń części twarzowej czaszki, w tym guzów żuchwy. Nieodzowne staje się także opracowanie wzorców postępowania, pozwalających na planowanie wydajnego leczenia,

opartego na dokładnej diagnostyce radiologicznej. Materiał stanowiły wyniki badań radiologicznych pochodzących ze 146 historii chorób 68 pacjentów, badanych w latach 1995-2000. Do analizy wybrano zdjęcia rentgenowskie, jak i dokumentację badań innymi metodami diagnostyki obrazowej, pacjentów, u których klinicznie potwierdzono obecność nowotworu żuchwy. Na podstawie otrzymanych wyników zaproponowano wzorzec postępowania diagnostycznego w przypadkach guzów gałęzi i kąta żuchwy, który został zaprezentowany w postaci schematu. Wykazano, że konwencjonalne zdjęcia rentgenowskie są nadal ważne we wstępnej fazie diagnostyki zmian żuchwy, podczas gdy wyniki badań innymi metodami są nieodzowne w planowaniu leczenia.