

Imaging findings of Ewing's sarcoma in the mandible

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Abstract: First described by James Ewing in 1921, Ewing's sarcoma (ES) or Ewing's tumor is one of the most aggressive bone tumors known. ES is an uncommon intra-osseous malignant tumor of questionable pathogenesis that occurs in children and young adults. Reports indicate that only 2 to 7% of cases involve the maxillofacial region, usually the mandible ramus, and few reported cases have involved the maxilla. In the present report of a case of ES of the mandible, we describe the results of imaging and evaluation after therapeutic treatment. This report provides a rare opportunity to observe radiologic features of ES in the mandible. (*J. Oral Sci.* 49, 167-171, 2007)

Keywords: Ewing's sarcoma; mandible; imaging; jaws.

Introduction

Ewing's sarcoma (ES) is a primary malignant tumor originally described by James Ewing in 1921. It is generally thought that ES arises from undifferentiated osseous mesenchymal cells. However, some immunohistochemical and tissue culture studies suggest that ES is derived from primitive neural tissue (1).

ES is one of the most aggressive bone tumors known, and accounts for 4 to 7% of primary bone malignancies. ES tends to affect the long bones: nearly 50% of reported cases have occurred in the femur or pelvic bones (2). ES usually develops during the first 2 decades of life, and affects males twice as often as females. Only 2 to 7% of cases involve the maxillofacial region, usually involving the mandible ramus, and few reported cases have involved the maxilla (2). Approximately 90% of reported cases occurring in the mandible have been primary lesions, and 10% have been metastases. Most ES lesions in the mandible have been located in posterior regions (3). ES appears to predominantly affect whites, with blacks and Asians being less frequently affected (2).

Rapid growth and propensity for metastasis are among the dominant features of ES; thus, jaw involvement may be due to metastasis from another skeletal site (4). Some reports indicate that the radiological features of ES in the mandible are characterized by a periosteal reaction in the form of sun-ray spicules (5-6), whereas others have described an "onion-skin" pattern of periosteal reaction in ES in the jaw (7).

It is noteworthy that in some cases of ES, development of the lesion has been preceded by an episode of trauma (2-8). The general radiologic appearance of ES is a mass accompanied by destruction of bone (5).

Here, we report a case of ES in the mandible occurring as a primary tumor with no metastasis, in a 14-year-old white male patient. We describe the results of different kinds of imaging, and the results of chemotherapy and radiotherapy.

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Case History

A 14-year-old white male presented at Boldrini Children's Center, Campinas, Brazil, complaining of swelling in the right mandible. The mass had appeared about 2 months before, after a trauma to the region. Since then, the mass had been growing progressively. The patient had a fever, and complained of dry mouth during the night.

On clinical examination, a hard immobile mass was detected in the right side of the mandible, involving the preauricular and mandible angle. This mass was not painful, and the only palpable lymph node was a posterior right cervical lymph node, which had a diameter of 1 cm. The intraoral exam revealed poor oral hygiene, and showed that the swelling extended from the second lower molar to the retro-molar region.

The radiogram of the right lateral mandible revealed a growing osteolytic, radiolucent area, with cortical destruction in the region of the ramus and angle of the mandible. Associated with this osteolysis was a periosteal reaction in the form of 'sun rays' spicules emanating from the inferior border of the mandible, and the suggestion of Codman's triangle at the anterior edge of inferior border of the mandible (Fig. 1a).

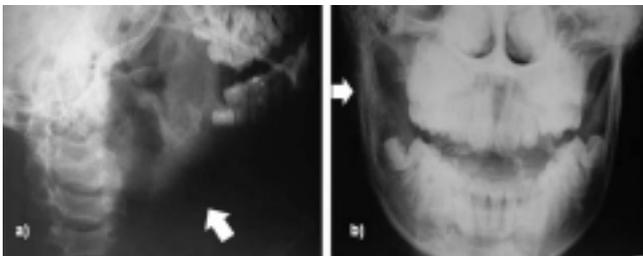


Fig. 1 (a) Lateral radiography of the mandible, showing the osteolysis and periosteal reaction ('sun rays') (arrow). (b) Postero-anterior radiography showing the right-side radiolucent area in the ramus and angle of the mandible.

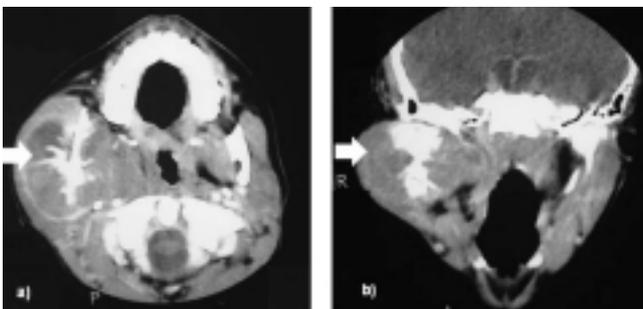


Fig. 2 Enhanced CT. (a) Axial CT showing the bone expansion and destruction by a soft mass that displaced the right-side parapharyngeal space (arrow). (b) Coronal CT showing the TMJ destruction and a soft mass extending to the right side of the mandible ramus.

The postero-anterior radiography of the mandible showed an expansive radiolucent area centered at the developing third lower molar, involving the ramus and the angle of the right mandible. There was cortical thinning and destruction in the region of the mandible ramus and angle (Fig. 1b). There were no abnormalities on plain chest or abdominal radiograms.

The myelogram did not show any malignant cells, but showed an increased level of lymphocytes.

The enhanced CT of the face revealed an expansive lesion (71 × 63 mm), with cortical and marrow lysis of the angle, ramus, condyle and coronoid process of the right mandible associated with the periosteal reaction. The lesion consisted of soft tissue of uniform density. Associated with this lesion were areas of hypocaptation of the contrast material, suggesting necrosis. The lesion, which had a poorly defined margin, projected to the masseter, lateral and medial pterygoid, and temporal muscles. The lesion also involved the right internal jugular vein. We observed lysis of the right lateral and posterior maxillary sinus walls. The right temporomandibular joint (TMJ) and parapharyngeal space were also involved (Fig. 2). The chest, abdominal and pelvis CT did not show any abnormalities.

Three-phase scintigraphy using technetium 99m methylene diphosphonate (^{99m}Tc) showed increased blood flow and hyperemia of the right mandible region in blood flow and blood pool phases, respectively, together with increased activity in the bone phase. The whole-body bone scan showed that the only bone area involved was the mandible (Fig. 3).

The T2-weighted magnetic resonance imaging (MRI) revealed a solid isointense lesion in the right-side angle

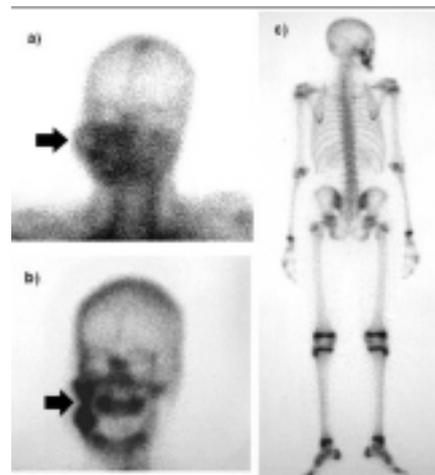


Fig. 3 Scintigraphy. (a) and (b) High uptake of ^{99m}Tc in the right mandible during different phases (arrows). (c) Whole-body bone scan showing that no bone other than the right mandible was involved.

of the mandible, with bone destruction. Laterally, the lesion involved the glande parotide, the masseter muscle and some of the ramus of the external carotid artery. Medially, the lesion involved the pterygoid and temporal muscles. There was no involvement of the cerebrum, cerebellum or other encephalic structures (Fig. 4).

Incisional biopsy of the involved tissue was performed. The histopathologic findings revealed a malignant neoplasm containing cells with round hyperchromatic nuclei and scant cytoplasm. Some osteogenesis of a reactive nature was observed. Mitotic figures were present, but were not abundant. The histopathologic diagnosis was ES.

The patient underwent chemotherapy consisting of sequential vincristine, isofamide, doxorubicin and etoposide. In addition, he received 5600 cGy over a 6-week period. Intercurrent problems of radiation and chemotherapy were all successfully treated.

After the treatment, CT and scintigraphy were used to follow-up the lesion. The CT showed that the tumor volume was 24 mm, which was a substantial reduction (about 63%). This reduction of tumor volume was confirmed by scintigraphy, which showed decreased uptake of ^{99m}Tc by the tumor (Fig. 5).

At present, 1 year after the initial diagnosis of ES, the patient is feeling well.

Discussion

Although ES is the second most frequent primary bone tumor in children, it is very rare in the mandible, which accounts for about 0 to 7% of all cases. ES occurs most frequently in long bones (9).

In the present case, swelling was the main complaint. In a study by Wood et al. (6), who analyzed 66 cases of primary ES of the mandible, swelling and pain were the most frequent complaints. In the present case, there was no loosening of teeth, trismus or ulceration, all of which were observed in a study of ES by Bacchini et al. (10).

Radiographically, the 'sun rays' lesion is a common finding; it has been observed in many studies (5-6), and it was observed on the present radiographs. The destructive osteolytic lesion is not a pathognomonic feature (6-8,10), as other lesions can have the same image pattern, including osteogenic sarcoma, neuroblastoma, lymphosarcoma, histiocytosis X, osteomyelitis, and metastatic carcinoma. Some findings, such as the presence of a large soft tissue mass and the age of the patient, can facilitate differentiation between ES and these lesions (11). Biopsy and histopathological examinations are important, as they provide the data used for final diagnosis of ES.

As previously reported (2-9,11), development of an ES lesion is often preceded by trauma; this was also true of

the present case.

In the present case, the patient age and gender and the site of the tumor in the mandible were similar to those of previous cases, as indicated by the findings of Arafat et al. (12), who reviewed 17 cases of ES of the jaw. In that review, the mean patient age was 16 years; only 2 patients were more than 24 years old; 10 of the patients were male; and 9 of the tumors were located in the posterior part of the mandible. In 2000, Fonseca et al. (13) reported a case of ES in a 35-year-old Caucasian woman in the posterior region of the mandible; what made that case uncommon is that ES rarely occurs after the third decade of life.

The present case demonstrates the importance of CT, scintigraphy and MRI. Without those imaging methods, the soft tissue involvement could be underestimated.

MRI is widely accepted as the imaging method of choice for evaluation of the extent of the primary lesion and its relationship with anatomic structures such as glands and muscles (9,12,14). In the present case, MRI was of great value in monitoring the effects of chemotherapy on the tumor.

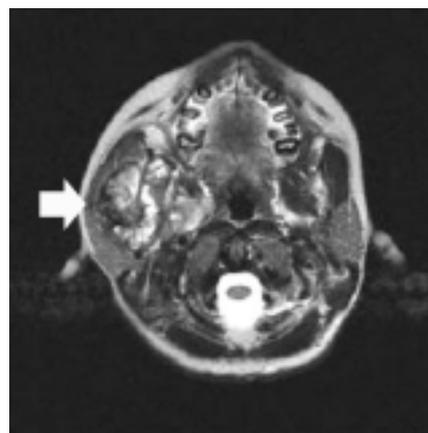


Fig. 4. Axial T2-weighted MRI showing a solid lesion in the right-side angle of the mandible with bone destruction (arrow).

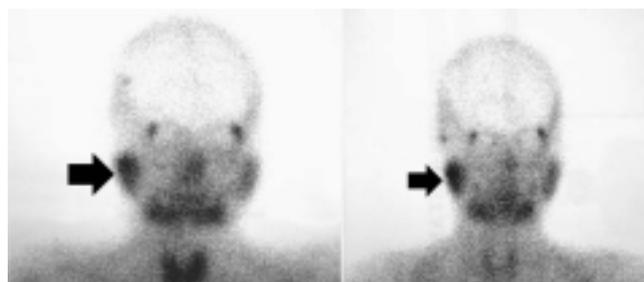


Fig. 5. Scintigraphy, after chemotherapy and radiotherapy, showing a considerable decrease in ^{99m}Tc uptake by the tumor (arrow).

In the present case, bone scintigraphy was used in the follow-up exam for detection of skeletal metastasis. Tumor volume reduction after the therapy was confirmed by the CT, and the scintigraphy showed considerable reduction in the uptake of the radiotracer. Several studies have demonstrated the usefulness of scintigraphy for diagnosis, control and detection of skeletal metastasis of ES (1-8,10,11). On the other hand, some authors (13) feel that it is inadequate to use only bone scintigraphy to monitor effects of chemotherapy in patients with ES, because of its low spatial resolution and low specificity. Follow-up exams after radiotherapy and chemotherapy can be made more reliable by using CT to supplement scintigraphy. We conclude that scintigraphy is a sensitive and efficient method of screening early metastasis.

As stated by van der Woude et al. (14), the aim of chemotherapy is to suppress potential micro-metastases and reduce the size of the primary tumor. This applies particularly well to ES, the tumor volume of which is substantially reduced by chemotherapy. van der Woude et al. concluded that the combination of radiation therapy and chemotherapy is useful to achieve local control in cases of inoperable lesions, and that surgery is most clearly indicated for lesions in expendable bones (e.g., fibulas, ribs), where no construction is needed. Singh et al. (11) reported that the cure rates of ES improved from 10% to 75% when multi-drug chemotherapy was combined with local therapy, which also produced decreases in the incidence of local disease recurrence and the development of pulmonary and skeletal metastases. Fonseca et al. (13) stated that radiotherapy must be used as a neoadjuvant therapy or to treat non-resectable primary radiosensitive tumors, and that chemotherapy must be reserved for prevention and treatment of metastasis. In the present case, conservative treatment was used instead of surgical treatment. Factors involved in the choice and success of therapy are the primary site of the tumor, localization of the tumor, the presence or absence of metastases, and the general condition of the patient. ES in facial sites generally has a better prognosis than ES in long bones or a pelvic location, because ES in facial sites is diagnosed earlier (11).

In summary, the present case provides useful data because it shows the results of different modalities for imaging of a rare primary ES tumor of the mandible, and the results of differential analysis. The imaging results show the size, position and stage of the tumor, which are useful for deciding on the therapeutic approach.

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