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Assessment of ameloblastomas using MRI and dynamic contrast-enhanced MRI

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Abstract

We retrospectively evaluated magnetic resonance images (MRI) and dynamic contrast-enhanced MRI (DCE-MRI) of ameloblastomas. MRI and DCE-MRI were performed for 10 ameloblastomas.

We obtained the following results from the MRI and DCE-MRI. (a) Ameloblastomas can be divided into solid and cystic portions on the basis of MR signal intensities. (b) Ameloblastomas show a predilection for intermediate signal intensity on T1WI, high signal intensity on T2WI, and well enhancement in the solid portion; they also show a homogeneous intermediate signal intensity on T1WI and homogeneous high signal intensity on T2WI, and no enhancement in the cystic portion. (c) The mural nodule or thick wall can be detected in ameloblastomas lesions. (d) CI curves of ameloblastomas show two patterns: the first pattern increases, reaches a plateau at 100–300 s, then sustains the plateau or decreases gradually to 600–900 s, while the other increases relatively rapidly, reaches a plateau at 90–120 s, then decreases relatively rapidly to 300 s, and decreases gradually thereafter. There was no difference in the CI curve patterns among primary and recurrent cases, a case with glandular odontogenic tumor in ameloblastoma or among histopathological types such as plexiform, follicular, mixed, desmoplastic, and unicystic type.

Keywords: Odontogenic; Benign tumor; MRI; Dynamic MRI; Histopathological type

1. Introduction

Ameloblastoma is a benign but locally invasive polymorphic neoplasm consisting of proliferating odontogenic epithelium, which usually has a follicular or plexiform pattern lying in a fibrous stroma [1]. It is the most common odontogenic tumor, and accounts for 1% of tumors and cysts of the jaw and 10% of odontogenic tumors [2–4]. Radiographically, ameloblastomas may show considerable variation reflecting their polymorphic features. The typical plain radiographic picture is of a multilocular destruction of bone, but unilocular ameloblastomas also occur [1]. These features are not diagnostically characteristic. In conventional radiography, differential diagnosis may include odontogenic keratocyst, odontogenic myxoma, dentigerous cyst, ameloblastic fibroma, giant cell granuloma, aneurysmal bone cyst, and other lesions [4]. Compared with conventional radiographies, CT usually helps in defining the contours of the lesion, its contents, and extension to the soft tissues [4]. CT may demonstrate the mural nodule in unilocular ameloblastoma, which can be helpful in differentiating the lesion from a dentigerous cyst [5–7]. The CT appearance may contribute to differentiation of ameloblastomas from other differential lesions. However, it is often difficult to differentiate ameloblastomas from other lesions, even if using CT, especially in differentiating ameloblastoma from dentigerous cysts in cases of unicystic lesions.

With its superior soft-tissue contrast and multiplanar facilities, magnetic resonance imaging (MRI) is the most useful

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modality for analyzing the internal structure of lesions [8]. The usefulness of MRI has been reported in the differential diagnosis of ameloblastoma [4–6]. Furthermore, it has been reported that dynamic contrast-enhanced MRI (DCE-MRI) reflecting intratumor angiogenesis [9,10] is useful in the differential diagnosis of some tumors, and many investigators have attempted to use it to identify differences between benign and malignant tumors, as well as to assess tumor malignancy [11–14].

In the present study, we retrospectively evaluated the MR features and DCE-MRI of ameloblastomas to assess whether MRI and DCE-MRI can provide additional information.

2. Materials and methods

2.1. Patient population

Ten patients underwent MR examination for ameloblastomas in Okayama University Hospital between July 1997 and July 2003. Of these 10, 8 were men and 2 were women; age ranged from 16 to 71 years, with a mean of 38.0 years. Eight patients had primary ameloblastomas, two recurrent ameloblastomas (cases 9 and 10), and one with glandular odontogenic tumor in ameloblastoma (case 4). Histopathological types included five plexiform, one follicular, one mixed, one desmoplastic, and two unicystic or cystic type.

2.2. MR images

MR imaging was performed on a 1.5-T unit (Magnetom vision; Siemens, Erlangen, Germany) with a circular polarized head coil or head–neck coil. Routine spin-echo (SE) T1-weighted images (T1WI: repetition time [TR] (ms)/echo time [TE] (ms) = 660–700/12–15) and turbo-SE (echo train length: 7) T2-weighted images (T2WI: TR/TE = 3000–4200/90) were acquired in the axial plane. Additional T1- and T2-weighted coronal and/or sagittal images were acquired with the same sequence.

After conventional T1WI and T2WI, Gd-DTPA (Magnevist; Nihon Schering, Osaka, Japan) was administered for 10 patients. The dynamic images were acquired in the axial or coronal plane with three-dimensional fast imaging with a steady-state precession (3D-FISP) sequence. The imaging parameters of the dynamic study were as follows: repetition time, 5 ms; echo time, 2 ms; flip angle, 25°; 16 partitions for 48 mm slub resulting in a 3.0 mm effective thickness; 250 mm field of view; and 256 × 256 matrix resulting in a 0.98 × 0.98 mm pixel size.

The dynamic images were acquired under the conditions of 20 consecutive scans at 1 s intervals (14 s/scan). Gd-DTPA (0.2 ml/kg) was administered manually at an approximate rate of 2.0 ml/s through an intravenous line. The beginning of the first scan was designated as time 0, and administration of Gd-DTPA was then started at 6 s before the second scan.

In addition, Gd-enhanced T1WI with a frequency-selective fat-suppression technique was carried out with the same parameters as the non-enhanced T1WI before administration of Gd-DTPA.

2.3. Image analysis

The MR images in 10 cases were retrospectively examined as follows. We could divide the contents of ameloblastomas into two portions of either solid or cystic components on the basis of MR signal intensities. The signal intensity within the solid or cystic portions was classified as homogeneous or heterogeneous. Regarding the signal intensity, a signal from the musculature was interpreted as intermediate on T1WI, and a signal from the cerebrospinal fluid as high on T2WI. The signal intensity between intermediate and high signal intensities on T1WI indicated a slightly high signal intensity.

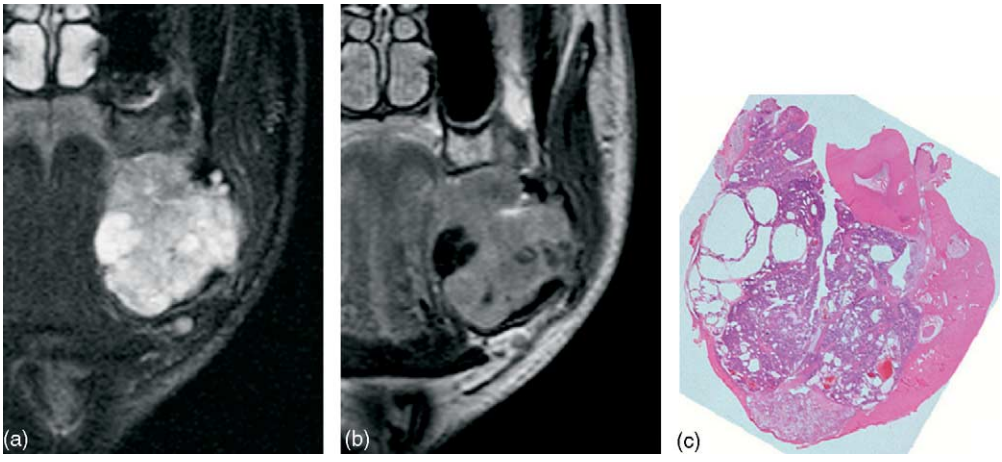

Fig. 1. Case 2: 27-year-old male. (a) Axial T2-weighted MR image shows a well-defined focal mass of heterogeneous high signal intensity with an extremely high signal spot at the left mandible (TR/TE = 4000/90). (b) On Gd-T1WI, there is well enhancement in the lesion. However, the area corresponding to the intermediate signal spot on T1WI and the extremely high signal spot on T2WI shows no enhancement on Gd-T1WI (TR/TE = 700/12). (c) Gross features of the resected tumor correspond to the coronal section of the MRI.