Ameloblastoma of the Mandible and Maxilla:
CT Findings

Jong Deok Kim, M.D., Jae Young Choi, M.D.

Purpose: To describe the characteristic CT findings of ameloblastomas in the mandible and maxilla.

Materials and Methods: CT findings of 11 patients with ameloblastoma (9 cases in the mandible and 2 cases in the maxilla) proved by excisional biopsy were evaluated retrospectively with regard to the location, size, multilocularity, solid and cystic component, cortical destruction, soft tissue invasion, and contrast enhancement.

Results: These were 8 multiloculated expansile and 1 unicystic (developed in a dentigerous cyst) mandibular ameloblastomas, and 2 unilocular maxillary ameloblastomas. All cases showed inhomogeneously enhancing solid component, nine of which were larger than cystic component. Nine cases, larger than 5 cm in diameter, revealed either a focal or extensive cortical destruction with various degree of invasion into the adjacent structures. One maxillary ameloblastoma contained a thick calcification along the margin of the lesion.

Conclusion: Maxillomandibular ameloblastomas appeared as expansile lesion containing enhancing solid component relatively larger than cystic portion and having cortical destruction in large lesions (>5 cm). Maxillary ameloblastomas were unilocular in appearance in spite of multilocularity in mandibular counterparts.

Index Words: Jaw, CT
Jaw, neoplasms

Although the ameloblastoma is the most common tumor that arises from the epithelial components of the embryonic tooth, this tumor comprises only 1% of all jaw cysts and tumors. Eighty percent of ameloblastomas are located in the mandible and the remaining 20% are found in the maxilla (1-3). As painless swelling is the most common early symptom of ameloblastomas in either jaw, delay in recognition of ameloblastoma is common and the time from onset of symptoms to treatment is often years. This slowly growing tumor is clinically and histologically benign, but it is locally invasive with a high rate of recurrence. Since ameloblastomas can proliferate within soft tissue, the detection of extracortical extent is of paramount importance to the surgeon.

CT plays an essential role not only in the diagnosis but also in detection of encroachment into the surrounding structures (4-6). We report CT findings of the ameloblastomas in the mandible and maxilla proved by surgical operation and histopathologic examination with review of the literature.

MATERIALS and METHODS

Nine patients with primary ameloblastoma and two patients with recurrent ameloblastoma in the mandible or maxilla were reviewed retrospectively. The diagnosis was proved at surgery and pathologic examination in all patients. There were 8 males and 3 females, with a mean age of 34 years (range, 12-64 years). All patients were examined with CT. At CT, contiguous axial and coronal sections 5 mm thick were obtained with either TCT-300S unit (Toshiba, Tokyo) or Somatom Plus unit (Siemens, Erlangen) before and after the administration of contrast material (drip infusion of 150 cc...
Ultravist 350, Schering, Germany). Other radiologic examinations included plain radiography (posteroanterior and both oblique mandible radiographs, dental radiographs, or occluded radiographs) and/or panoramic radiography in all cases.

CT findings were evaluated with regard to the location, size, multilocularity, solid and cystic component, cortical destruction, soft tissue invasion, and contrast enhancement of the lesions.

**RESULTS**

The computed tomographic analysis of 11 ameloblastomas is shown in the Table 1.

Nine tumors were located in the mandible and two were located in the maxilla. Two of nine mandibular tumors were postoperative recurrent cases. The range of long diameter of the tumors was 3—14.5 cm (mean, 8 cm).

In the nine cases of mandibular ameloblastoma, eight tumors were multilocular. One unicystic ameloblastoma of the mandible (developed in a dentigerous cyst) and two maxillary ameloblastomas were unicellular. Each locule was larger than 1 cm in size in all cases except for two small mandibular tumors and the latter contained both large and small locules. Nine tumors, larger than 5 cm in diameter, revealed either focal or extensive cortical destruction with extension of the tumor into the adjacent structures, which ranged from a small localized mass formation to severe encroachment into the infratemporal or pterygopalatine fossa, masticator or buccal space, or orbit (Fig. 1). The remaining two tumors were smaller than 5 cm in diameter and they did not reveal cortical destruction.

All ameloblastomas except one were mixed solid and cystic type. After the injection of contrast material,
various degree of inhomogenous enhancement was demonstrated in all cases including unicystic ameloblastoma. In nine tumors, the enhancing solid portion was larger than cystic portion(Fig. 1 and 2). One maxillary ameloblastoma contained a thick calcification along the margin of the lesion(Fig. 3).

Resorption of the tooth root or displacement of the tooth was seen in five cases, which was demonstrated better on panoramic radiographs than on plain radiographs or CT. Bony septa were visualized as well on plain radiographs or panoramic radiographs as on CT in eight multilocular tumors. Extension of the tumor into the adjacent structures and its boundary with the normal tissue were well delineated on CT but not on plain or panoramic radiographs.

Three-dimensional-reconstruction images obtained in two patients well demonstrated extensive bulging and destruction of the mandible in one(Fig. 1) and intact cortex in the other.

**DISCUSSION**

Since ameloblastomas originate within bone and grow slowly, early symptoms are usually absent or minimal. A painless mass is common in the mandibular form of the disease, while nasal obstruction and localized facial swelling are frequent in maxillary tumors. They may occur at any age, but the usual age at discovery is the fourth decade. Half of the mandibular lesions are located in the molar region and in the maxilla, approximately 50% are found in the molar region, 30% in the area of antrum, and the rest at other sites, including less than 2% in the anterior maxilla(6-7).

There are three clinical types of ameloblastomas (8-11): (1) the solid intraosseous or multicystic type can be histologically invasive with a high rate of recurrence, (2) the well-circumscribed unicystic type (the development of ameloblastomas in the wall of cysts: mural ameloblastomas) is less aggressive with distinctly low recurrence rate, and (3) the rare peripheral extraosseous type. Although benign, ameloblastomas are nonencapsulated and locally invasive with a high recurrence rate unless adequate surgical resection is performed and maxillary ameloblastomas are inherently more difficult to treat and are considered more aggressive than their counterparts in the mandible. The typical ameloblastoma begin insidiously as a central lesion of bone and is slowly destructive with a tendency to bone expansion. However, the cortex may be eroded

| Table 1. CT Findings of Ameloblastoma in Mandible & Maxilla |
|---------------------------------|-------------------|-----------------
| Site                           | CT Findings       |                 |
|                                | Mandible (n=9)    | Maxilla (n=2)  |
| Size (cm)                      | 3 - 14.5          | 3 - 8          |
| Locularity                     |                   |                 |
| Multilocular                   | 8                 | 0              |
| Unilocular                     | 1*                | 2              |
| Type                           |                   |                 |
| Cystic                         | 1*                | 0              |
| Solid                          | 0                 | 0              |
| Mixed                          | 8                 | 2              |
| Cortical destruction           |                   |                 |
| Focal                          | 4                 | 2              |
| Extensive                      | 3                 | 0              |
| Contrast enhancement           | 9**               | 2              |

* Unicystic ameloblastoma
** Enhancing solid component was larger than cystic component in 9 patients.

Fig. 2. 12-year-old boy.
Postcontrast axial(a) and coronal CT scans show a large expansile, solid and cystic mass in the left mandible. The solid component within the mass is larger than cystic one. Partial cortical destructions are present.
and thinned and finally disrupted. Marginal resection is necessary to reduce the rate of recurrence from residual tumor. In addition, if extracortical extent is seen, an adequate margin of surrounding soft tissue must be resected since ameloblastomas can proliferate in soft tissues(5-6, 12-13).

Plain radiographs show an expansile unilocular or multilocular lytic lesion with a “honeycomb or soap-bubble” appearance and sharp scalloped peripheral border. Resorption or deviation of dental roots may be present. Occasionally, the crown of a tooth may be found in association with the tumor, but if calcifications are found radiographically, the lesion is probably not an ameloblastoma. When locules are smaller than 1 cm in diameter, they tend to be numerous, resembling a honeycomb pattern. Larger locules tend to be fewer in number and show soap-bubble appearance. When the tumor is multilocular, the cystic portions commonly appear larger in the posterior part than in the anterior part of the mandible. On CT, ameloblastomas appear as an inhomogenous, multilocular or multisepated soft tissue mass containing areas of low attenuation separated by curvilinear areas of intermediate or high attenuation. Plain radiograph, panoramic radiograph, conventional tomograph, and CT reveal shell-like bulyings of the cortex or cortical destruction and allow determination of whether the tumors are multilocular or unilocular, but extension of the tumor into the adjacent structures are delineated more clearly on CT than on radiographs. MR imaging is superior to plain radiographs and CT in demonstrating components of the tumor, features of the walls of cystic components, and the nature of cystic fluids but not in delineating cortical margins and soft tissue invasion. MR imaging is also useful in investigating the recurrence because MR imaging has the potential to allow distinction of recurrent lesions from postoperative fibrosis by means of different signal intensity on T2-weighted images. CT is more useful than MR imaging when a lesion is small and the cortical bone around the lesion is considered to be preserved at plain radiographs, while three-dimensional evaluation with MR imaging is more helpful for surgical planning in the case of extensive invasion of the adjacent soft tissue(4-6, 14-20).

In our study, all mandibular ameloblastomas except one unicystic type(90%) were multilocular and all maxillary tumors(100%) were unilocular expansile lesions. All tumors except two small mandibular ameloblastomas, less than 5 cm in diameter, had cortical destruction and large locules. Extensive soft tissue invasion was seen in two recurrent and one primary mandibular ameloblastomas. All cases demonstrated various degree of inhomogeneous enhancement in solid portion on postcontrast CT and in 82% of them, solid portion was larger than cystic portion. Minami et al.(18) reported that 13 of 14 maxilomandibular ameloblastomas showed strong enhancement of solid components on enhanced MR imaging and they th-
ought that hypervascularity of some ameloblastomas could explain the marked gadolinium enhancement.

An unusual finding in our study was seen in a 63-year-old man with a 28-year-history of painless cheek mass and an oroantral fistula of 8-year-duration (Fig. 3). A thick calcification was seen along the margin of unilocular maxillary antral lesion in addition to soft tissue mass formation around the cortical destruction at antero-inferior maxilla. This calcified lesion appeared as a large air cavity and it seemed to arise from free entrance of the air through the oroantral fistula near the cortical destruction, which developed after an extraction of maxillary second premolar tooth 8 years previously. In the literature we could find only four cases of maxillomandibular ameloblastomas with calcification, and the first two of them were with only small amount of dystrophic calcification, the second one with numerous calcified keratin pearls, and the last one with a poorly organized mass resembling cementum (22-23). Keratinization and dystrophic calcifications are also commonly seen in craniopharyngiomas, the pituitary counterpart of ameloblastoma of the jaw bones (21). In our case it was dystrophic calcification.

In conclusion, maxillomandibular ameloblastomas appeared as expansile lesion containing enhancing solid component relatively larger than cystic portion and having cortical destruction in large lesions (5 cm >). Maxillary ameloblastomas were unilocular in appearance in spite of multilocularity in mandibular counterparts.

REFERENCES
상악골 및 하악골 법랑아세포종의 CT 소견

김종덕·최재영

목적: 상악골과 하악골 법랑아세포종의 CT소견을 분석하여 그 특징을 알아보고 발생장소에 따른 차이점 유무를 살펴보기 위한 연구입니다.

대상 및 방법: 수술 및 조직소견으로 정확한 2예의 상악골 법랑아세포종과 9예의 하악골 법랑아세포종(수술 후 재발된 2예 포함)을 대상으로 하였으며, CT소견은 종양의 위치, 크기, 다방성 혹은 단방성, 고형성 혹은 낭성, 조영증강 유무, 골피질 미란 및 파괴와 주위 연조직 침습 여부를 후향적으로 분석하였다.

결과: 하악골 법랑아세포종 9예 중 1예는 단일낭성 종양(unicystic type)을 제외한 8예에서 다방성의 평창성 종괴로 나타났고, 상악골 법랑아세포종 2예는 다방성의 평창성 종괴로 나타났다. 11예 모두 근위의 골형성 부분에 불균등한 조영 증강을 나타내었으며 이중 9예에서는 이 부위가 낭성 부분보다 컸다. 직경이 5cm 이상인 종양 9예에서는 국소적 또는 광범위한 골피질 파괴와 함께 다양한 정도의 주위 연조직 침습을 나타내었다. 1예의 상악골 법랑아세포종에서는 종양 주변부를 따라 두터운 석회화가 나타났다.

결론: 하악골과 상악골 법랑아세포종은 모두 평창성종괴로서 조영증강되는 골형성 부분이 낭성 부분보다 더 크며, 골피질의 파괴는 직경이 5cm 이상의 큰 종양에서 나타났다. 하악골과 상악골 법랑아세포종의 차이점으로는 전자는 다방성, 후자는 단방성 종괴임을 들 수 있었다.