

AMELOBLASTOMA: CLINICAL FEATURES, DIAGNOSIS AND MODERN TREATMENT APPROACHES

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АННОТАЦИЯ:

. Ameloblastoma is a rare, locally aggressive odontogenic tumor that originates from epithelial tissues associated with tooth development. Although it is generally considered a benign neoplasm, its locally invasive behavior, high potential for bone destruction, and tendency to recur make it an important clinical problem in maxillofacial surgery and dentistry. The tumor most frequently develops in the posterior region of the mandible and may remain asymptomatic during its early stages. As the lesion progresses, patients can develop painless facial swelling, jaw expansion, tooth displacement, malocclusion, and, in advanced cases, pain, cortical bone perforation, and functional impairment.

Accurate diagnosis of ameloblastoma requires a combination of clinical examination, radiographic imaging, and histopathological evaluation. Panoramic radiography and computed tomography are particularly useful for determining the extent of bone involvement and planning treatment. Histopathological examination remains essential for establishing the definitive diagnosis. The treatment strategy depends on the histological subtype, tumor size, anatomical location, and extent of local invasion. Conservative approaches may be considered in selected cases, whereas surgical resection with adequate margins is commonly preferred

for extensive or recurrent tumors. Reconstruction of the resulting jaw defect plays an important role in restoring facial symmetry and oral function.

This article reviews the main clinical, diagnostic, pathological, and therapeutic aspects of ameloblastoma and discusses contemporary approaches to its management.

Ameloblastoma is one of the most clinically significant odontogenic tumors encountered in maxillofacial practice. It is characterized by slow but progressive growth and a marked tendency to infiltrate surrounding bone. Despite its benign histological classification in most cases, ameloblastoma can produce extensive local destruction and significant functional and aesthetic complications.

The tumor is believed to originate from odontogenic epithelium and may develop from remnants of the dental lamina, enamel organ, epithelial lining of odontogenic cysts, or other epithelial structures involved in tooth development. Ameloblastomas are most frequently diagnosed in adults, particularly during the third to fifth decades of life.

The posterior mandible, especially the molar and ramus regions, represents the most common anatomical site. However, lesions may also occur in the maxilla. Maxillary ameloblastomas require particular attention because the tumor can extend into the maxillary sinus, nasal cavity, orbit, and skull base before becoming clinically evident. The clinical significance of ameloblastoma is associated not only with its capacity for local invasion but also with its potential for recurrence following inadequate treatment. Therefore, early recognition, appropriate imaging, histopathological confirmation, and individualized treatment planning are essential for achieving favorable outcomes. The exact etiology of ameloblastoma remains incompletely understood. Current evidence suggests that the tumor develops as a result of genetic and molecular alterations affecting odontogenic epithelial cells. Molecular studies have identified several signaling pathways involved in ameloblastoma development. Mutations affecting the mitogen-activated protein kinase (MAPK) pathway, particularly alterations involving the BRAF gene, have been detected in a substantial proportion of cases. Other molecular abnormalities involving the SMO, RAS, and related signaling pathways have also been described.

The biological behavior of ameloblastoma is influenced by the interaction between tumor cells and the surrounding microenvironment. Tumor cells may stimulate osteoclastic activity, resulting in progressive resorption of adjacent bone. This mechanism contributes to the characteristic expansile and infiltrative growth of the lesion.

Several histological variants of ameloblastoma have been described, including conventional/solid or multicystic ameloblastoma, unicystic ameloblastoma, and peripheral or extraosseous ameloblastoma. These variants differ in their clinical presentation, radiological characteristics, and biological behavior.

The clinical manifestations of ameloblastoma depend largely on the size and anatomical location of the tumor. In the early stages, the lesion may be completely asymptomatic and

discovered incidentally during routine dental radiographic examination. As the tumor increases in size, patients commonly develop gradual, painless swelling of the jaw.

Typical clinical manifestations include:

- painless facial or intraoral swelling;
- expansion of the jaw;
- asymmetry of the face;
- displacement of adjacent teeth;
- tooth mobility;
- malocclusion;
- delayed eruption of teeth;
- cortical bone expansion or perforation;
- pain or discomfort in advanced cases;
- paresthesia in cases involving adjacent neural structures.

The slow growth of the tumor can result in significant enlargement before diagnosis. In advanced mandibular lesions, substantial destruction of the jaw may occur, affecting mastication, speech, swallowing, and facial appearance.

Radiological examination is an essential component of ameloblastoma diagnosis and treatment planning. Panoramic radiography is commonly used as an initial imaging modality. Conventional ameloblastomas frequently demonstrate a multilocular radiolucent appearance with characteristic internal septations. This appearance has sometimes been described as resembling a “soap bubble” or “honeycomb” pattern. Unicystic lesions may present as well-defined unilocular radiolucencies, making differentiation from odontogenic cysts difficult based solely on radiographic findings. Computed tomography (CT) provides more detailed information regarding the extent of cortical bone destruction, involvement of the mandibular canal, soft-tissue extension, and relationship with adjacent anatomical structures. CT is particularly valuable when surgical treatment is being considered. Magnetic resonance imaging (MRI) may be useful in selected cases, especially when soft-tissue involvement or extension into adjacent structures needs to be evaluated. Radiological findings alone, however, cannot establish a definitive diagnosis. Histopathological examination is required to confirm ameloblastoma.

Histopathology plays a central role in the diagnosis and classification of ameloblastoma. The conventional solid or multicystic type may demonstrate islands and cords of odontogenic epithelium within a fibrous stromal background. Peripheral tumor cells commonly show a characteristic palisaded arrangement, while the central portion of the epithelial islands may resemble the stellate reticulum of the developing enamel organ. Several histological patterns have been recognized, including follicular and plexiform patterns, as well as acanthomatous, granular cell, basal cell, and other less common variants. Unicystic ameloblastoma is characterized by a cystic cavity lined by ameloblastic epithelium. The tumor may be limited to the cyst lining or may demonstrate mural proliferation into the surrounding

connective tissue. This distinction is clinically important because the risk of recurrence and the choice of treatment can vary according to the extent of tumor infiltration.

Peripheral ameloblastoma develops primarily in soft tissue rather than within the jawbone. It generally demonstrates less aggressive behavior than intraosseous forms.

The differential diagnosis of ameloblastoma includes several odontogenic and non-odontogenic lesions.

Depending on its radiographic appearance, differential diagnoses may include:

- odontogenic keratocyst;
- dentigerous cyst;
- odontogenic myxoma;
- central giant cell granuloma;
- aneurysmal bone cyst;
- odontogenic tumors of other types;
- intraosseous malignant lesions in selected cases.

The presence of a multilocular radiolucency in the posterior mandible, particularly in an adult patient, should raise suspicion of ameloblastoma. Nevertheless, clinical and radiographic findings must always be correlated with histopathological examination.

Modern Treatment Approaches

The principal objective of ameloblastoma treatment is complete elimination of the tumor while preserving or restoring facial structure and oral function. Treatment selection depends on several factors, including tumor size, anatomical location, histological subtype, cortical bone involvement, soft-tissue extension, patient age, and history of recurrence. Conservative Treatment Conservative approaches may include enucleation, curettage, and marsupialization in carefully selected cases.

These techniques may be considered particularly for some unicystic ameloblastomas, especially when the lesion is small and does not demonstrate significant mural invasion. Conservative management can reduce surgical morbidity; however, it may be associated with a higher risk of recurrence in tumors with infiltrative growth patterns. Radical Surgical Treatment For large, conventional, or recurrent ameloblastomas, surgical resection is generally considered the most reliable treatment. Depending on the extent of the lesion, surgical procedures may include marginal resection or segmental mandibulectomy. Adequate surgical margins are important because microscopic tumor extensions may extend beyond the radiographically visible lesion. The choice between conservative and radical surgery should therefore be individualized rather than based solely on tumor size.

Extensive resection of mandibular ameloblastoma may result in significant functional and aesthetic defects. Reconstruction is therefore an important component of comprehensive treatment.

Reconstructive options include:

- reconstruction plates;

- non-vascularized bone grafts;
- vascularized free flaps;
- fibular free flap reconstruction;
- other microsurgical reconstructive techniques.

The vascularized fibula free flap has become an important option for reconstruction of extensive mandibular defects because it can provide adequate bone length and vascularized tissue for restoration of mandibular continuity. Successful reconstruction aims to restore mandibular form, facial symmetry, mastication, speech, and, when appropriate, facilitate subsequent dental rehabilitation.

Although ameloblastoma is generally benign, recurrence is an important clinical concern. The risk of recurrence depends on tumor subtype, biological behavior, treatment method, and completeness of tumor removal. Conservative procedures may be associated with higher recurrence rates in comparison with adequate surgical resection of conventional infiltrative tumors. Recurrence can occur several years after initial treatment, which emphasizes the importance of long-term follow-up. Patients who undergo treatment for ameloblastoma should receive regular clinical and radiological examinations. Follow-up is particularly important after conservative treatment and in cases involving recurrent disease. Malignant transformation and metastasis are rare but recognized phenomena. Ameloblastic carcinoma and metastasizing ameloblastoma represent uncommon conditions requiring specialized multidisciplinary management.

The diagnosis and treatment of ameloblastoma remain important challenges in maxillofacial surgery. The tumor often develops slowly and may remain clinically silent for a considerable period. Consequently, patients may present only after significant jaw expansion has occurred. Advances in imaging have improved the ability to determine tumor extent before surgery. CT is especially useful for evaluating cortical destruction and anatomical relationships, while MRI can provide additional information concerning soft-tissue involvement. At the same time, molecular research has increased understanding of the mechanisms underlying ameloblastoma development. Identification of mutations in the MAPK pathway, particularly BRAF alterations, has contributed to a better understanding of tumor biology and may provide opportunities for targeted treatment in selected advanced or unresectable cases. The management of ameloblastoma should therefore involve a multidisciplinary approach incorporating oral and maxillofacial surgeons, dentists, radiologists, pathologists, and, when necessary, reconstructive surgeons and oncologists.

Conclusion

Ameloblastoma is a benign but locally aggressive odontogenic tumor that most commonly affects the posterior mandible. Its slow growth may delay diagnosis, while progressive bone destruction can lead to considerable functional and aesthetic impairment. A reliable diagnosis requires the integration of clinical examination, radiological imaging, and histopathological assessment. Treatment should be individualized according to tumor subtype, size, anatomical

location, extent of invasion, and recurrence status. Conservative treatment may be appropriate for selected lesions, particularly certain unicystic forms, whereas extensive or recurrent conventional ameloblastomas frequently require surgical resection. Reconstruction of large mandibular defects is essential for restoring facial appearance and oral function. Early diagnosis, appropriate surgical planning, adequate tumor removal, and long-term follow-up remain the principal factors associated with favorable clinical outcomes.

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