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Human Ameloblastoma: Pathogenesis, Clinical Presentation, Management, and Future Perspectives: A brief Review

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Abstract

Ameloblastoma, a benign yet locally aggressive odontogenic tumor poses significant diagnostic and therapeutic challenges. This review intends to present a synopsis of human ameloblastoma's different aspects, including its pathogenesis, clinical presentation, diagnostic modalities, treatment strategies, and emerging research avenues from previously reported articles. By analyzing existing literature and clinical insights, this manuscript improved the understanding and facilitated optimal management of ameloblastoma, the complex pathology.

Keywords: Ameloblastoma, odontogenic tumor, clinical presentation, management, molecular markers.

Introduction

Ameloblastoma represents one of the most clinically challenging odontogenic tumors encountered in dental and maxillofacial practice (1, 2). Despite its benign nature, the propensity for local aggressiveness and high recurrence rates pose significant clinical dilemmas (3). This review explains current knowledge on ameloblastoma, focusing on its etiology, histopathological characteristics, clinical presentation, diagnostic modalities, treatment options, and emerging therapeutic strategies.

Etiology and Pathogenesis

The precise etiology of ameloblastoma remains vague (4,5), while various genetic, molecular, and environmental factors have been implicated. Recent research suggests the multifactorial pathogenesis involving dysregulation of signaling pathways such as Wnt/β-catenin, Sonic Hedgehog, and Notch (6). Moreover, mutations in genes like BRAF and CTNNB1 have been determined in some cases (7). Understanding the molecular mechanisms underlying ameloblastoma development is crucial for targeted therapeutic interventions (8, 9).

Clinical Presentation

Clinically, ameloblastomas often manifest as slow-growing, painless swellings in the jawbones, most commonly the mandible (10, 11). Radiographically, they present as radiolucent lesions with well-defined borders, exhibiting unilocular or multilocular patterns (12, 13), associated with variations in clinical appearance depending on the histological subtype, tumor size, and anatomical location, necessitating comprehensive evaluation for accurate diagnosis and treatment planning (Figure.1) (8,13).

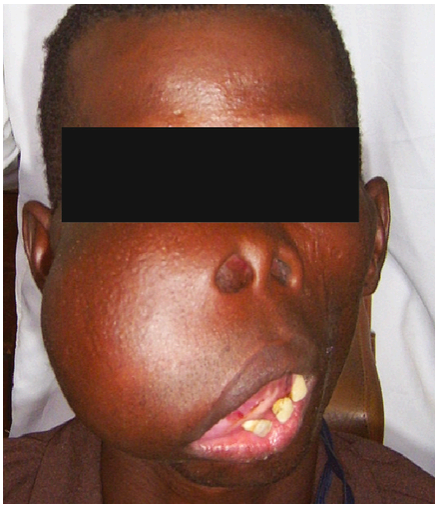

Figure.1: shows widespread right maxillary ameloblastoma comprising facial disfigurement and displacement of teeth. (Effiom OA, Ogundana OM, Akinshipo AO, Akintoye SO. Ameloblastoma: current etiopathological concepts and management. Oral Diseases. 2018;24:307–316 doi:10.1111/odi.12646)

Histopathological Features

Histologically, ameloblastomas display diverse morphological patterns, including follicular, plexiform, acanthomatous, and basal cell types (Figure. 2, 3) (1, 13). The characteristic features include islands or strands of odontogenic epithelium with peripheral palisading and central stellate reticulum-like cells (9). Variations in stromal

components, such as fibrosis, calcification, or cystic degeneration, further contribute to histopathological diversity and may influence clinical behavior.

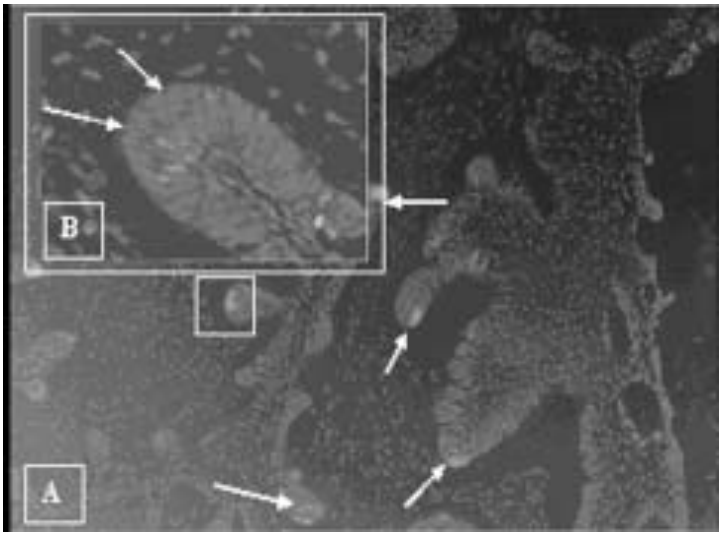

Figure.2: Shows the immunohistochemistry stain for p53 in ameloblastoma Variant type A: X200 magnification, B: X360 magnification. (Al-Salihi KA and Ling Yoke Li and Ahmad Azlina. P53 gene mutation and protein expression in ameloblastomas. Braz J Oral Sci. 2006;5(17): 1034-1040.

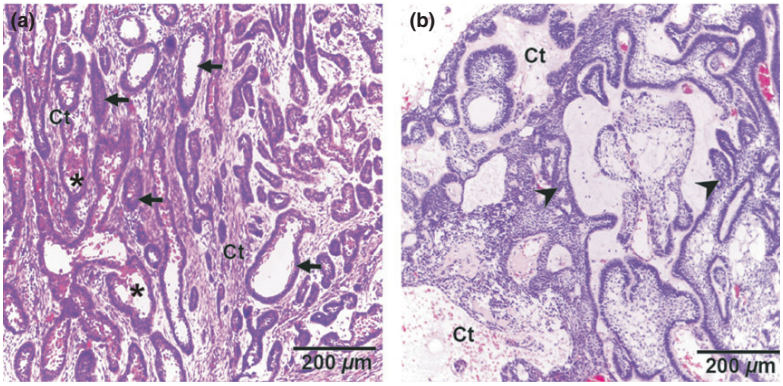

Figure.3: Displays conventional ameloblastoma (solid/ multicystic). a: Follicular ameloblastoma; b. Plexiform ameloblastoma (Effiom OA , Ogundana OM , Akinshipo AO , Akintoye SO. Ameloblastoma: current etiopathological concepts and management. Oral Diseases. 2018;24:307–316 doi:10.1111/odi.12646)

Diagnostic Modalities

Accurate diagnosis of ameloblastoma relies on clinical, radiographic, and histopathological assessments (12, 14, 13). Imaging modalities such as panoramic radiography, computed tomography (CT), and magnetic resonance imaging (MRI) help assess the extent of tumor involvement and guide surgical planning (Figure.4). Fine-

needle aspiration cytology (FNAC) may provide preoperative diagnostic information, although definitive diagnosis requires histopathological examination of biopsy specimens (15).

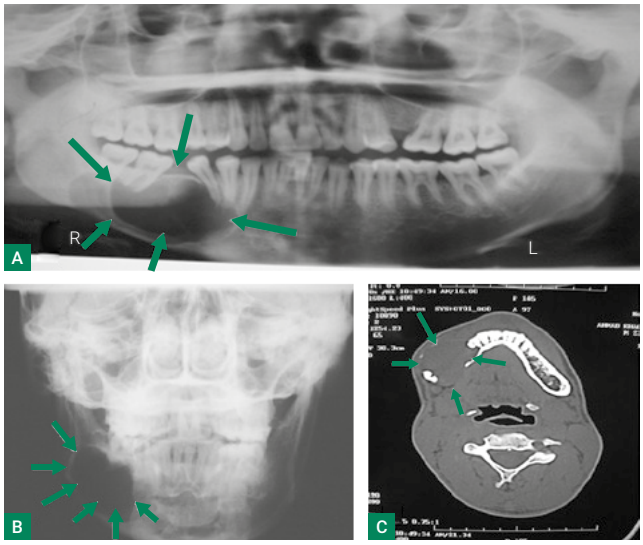

Figure.4: Displays ameloblastoma variant type. A & C: OPG and MRI showing uninoculated radiolucency with smooth borders and displacement of teeth. B: a radiolucent area in the right angle of mandible. (Al-Salihi K A, Ihsan Abdullah, Ling Yoke Li Clinico-radiologic features of four cases of Ameloblastoma. Brazilian Journal of Oral Sciences. 2018; 17:e18028. http://dx.doi.org/10.20396/bjos.v17i0.8651903).

Treatment Strategies

Surgical treatment, including resection, remains the primary treatment method for ameloblastoma, aiming for complete excision while preserving function and aesthetics (16). Various surgical approaches may be employed based on tumor size, location, and histological subtype, including conservative enucleation, curettage, segmental resection, and reconstruction with bone grafts or alloplastic materials. However, some adjuvant treatments like chemotherapy and radiation are committed for select cases with aggressive behavior or unresectable disease (16).

Recurrence and Prognosis

Despite adequate surgical treatment, ameloblastomas exhibit a high propensity for recurrence, necessitating long-term follow-up and vigilant surveillance (15, 16). The risk of recurrence varies depending on factors such as histological subtype, surgical technique, and margin status. Early detection of recurrence enables prompt intervention, potentially improving patient outcomes and minimizing morbidity.

Emerging Therapeutic Strategies

Recent advances in molecular biology and targeted therapy offer promising opportunities for managing ameloblastoma (7,17). Identifying molecular markers and signaling pathways implicated in tumor pathogenesis may facilitate the development of novel targeted agents or immunotherapeutic approaches. Besides, progress in regenerative medicine and tissue engineering has the potential for innovative reconstructive strategies post-surgery (16).

Conclusion

Ameloblastoma poses significant diagnostic and therapeutic challenges due to its locally aggressive behavior and high recurrence rates. The multidisciplinary approach involving oral and maxillofacial surgeons, pathologists, radiologists, and oncologists is essential for comprehensive management. Further research focusing on elucidating the molecular mechanisms, identifying predictive biomarkers, and exploring targeted therapeutic interventions is affirmed to enhance patient outcomes and quality of life.

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Competing interests statement

The authors declare that they have no conflict of interest upon publish this article.

Ethics statement

The authors confirm that the ethical policies of the journal, as noted on the journal's author guidelines page, have adhered to.

Author contributions

NAN: worked with collection of previously published article and wrote the first draft of the manuscript; KAA: provided the concepts of this brief review, and review the previously published articles which used in writing this article, in addition to review the final draft; ZTA: revised the article items and final draft.

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