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Research Article

The Comparative Evaluation of Conservative and Radical Surgical Approaches in the Management of Ameloblastoma: A Retrospective Study

Rabia Rafiq[1], Hammad Wazir[2], Nadia Burair[3], Mazhar Khan[4], Manzoor Khan[5], Mansoor Ahmad Miani[6*], Muhammad Ilyas[7]

[1]BDS, FCPS, Senior Registrar Oral & Maxillofacial Surgery, Niazi Medical & Dental College, Sargodha, Pakistan.

[2,3,5,6*]BDS, FCPS, Consultant Oral & Maxillofacial Surgeon, Health Department, Khyber Pakhtunkhwa, Pakistan.

[4]BDS, FCPS, Senior Registrar Oral & Maxillofacial Surgery, SMDAS, Pak Austria Fachhochschule, Haripur, Pakistan.

[7]BDS, FCPS, MFDRCSI, MFDS RCSEd, Consultant Oral & Maxillofacial Surgeon, Health Department, Khyber Pakhtunkhwa, Pakistan.

Corresponding Author: Mansoor Ahmad Miani

BDS, FCPS, Consultant Oral & Maxillofacial Surgeon, Health Department, Khyber Pakhtunkhwa, Pakistan.

Email: mansoorahmadtk@gmail.com

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ABSTRACT

Background: Ameloblastoma is a benign but locally aggressive odontogenic tumor with a significant tendency for local recurrence. The optimal surgical approach remains controversial because conservative procedures may preserve function and aesthetics but can be associated with higher recurrence, whereas radical resection may provide better local control at the cost of greater morbidity.

Objective: To compare recurrence and postoperative outcomes following conservative and radical surgical management of ameloblastoma over a 20-year period.

Methods: This retrospective comparative study included 20 patients with histopathologically confirmed ameloblastoma treated between January 2006 and December 2025. Patients were divided into conservative and radical treatment groups according to the definitive surgical procedure. Demographic, clinical, radiographic, histopathological, treatment, postoperative complication, follow-up, and recurrence data were recorded. Categorical variables were analyzed using Fisher's exact test and continuous variables using the Mann–Whitney U test. A p-value <0.05 was considered statistically significant.

Results: Nine patients (45.0%) underwent conservative treatment and 11 (55.0%) underwent radical treatment. The median tumor size was significantly smaller in the conservative group than in the radical group (4.0 cm vs. 5.8 cm; p=0.002). Overall recurrence occurred in 5 patients (25.0%). Recurrence was observed in 4 of 9 patients (44.4%) treated conservatively compared with 1 of 11 patients (9.1%) treated radically; however, this difference was not statistically significant (p=0.127). Postoperative complications occurred in 1 patient (11.1%) in the conservative group and 5 patients (45.5%) in the radical group (p=0.157).

Conclusion: Radical treatment demonstrated a lower observed recurrence rate, while conservative treatment was associated with fewer postoperative complications.

Keywords: Ameloblastoma, Conservative Surgery, Radical Surgery, Recurrence, Postoperative Complications, Oral and Maxillofacial Surgery.

INTRODUCTION

Ameloblastoma is a benign odontogenic epithelial neoplasm characterized by slow growth, local infiltration, destruction of the jaws, and a clinically important tendency toward recurrence. Although histologically benign in most cases, its biological behavior may be locally aggressive, producing progressive expansion of the cortical plates, displacement or resorption of teeth, perforation of cortical bone, extension into adjacent soft tissues, and substantial facial deformity when diagnosis or treatment is delayed.[1]These characteristics distinguish ameloblastoma from many other benign odontogenic lesions and make its management one of the more

challenging areas of oral and maxillofacial surgery. The principal therapeutic objective is complete and durable tumor control while preserving, whenever possible, mandibular or maxillary continuity, facial form, masticatory function, speech, and overall quality of life.[1,2]

Ameloblastoma arises from odontogenic epithelium and is believed to originate from remnants of the dental lamina, enamel organ, epithelial lining of odontogenic cysts, or basal cells of the oral epithelium.[2,3] It occurs predominantly within the jaws, with the mandible affected considerably more frequently than the maxilla. Within the mandible, the posterior body, angle, and ramus represent the most commonly involved regions.[2,4] Maxillary ameloblastomas are less frequent but may pose particular therapeutic difficulties because the relatively thin maxillary cortical bone provides less anatomical resistance to tumor spread. Consequently, maxillary lesions may extend into the maxillary sinus, nasal cavity, orbit, pterygopalatine region, or skull base before producing conspicuous clinical manifestations.[3,4]

Clinically, ameloblastoma frequently presents as a painless, slowly enlarging swelling. Pain, altered sensation, tooth mobility, malocclusion, and limitation of jaw function may develop as the tumor increases in size. Radiographically, lesions may demonstrate unilocular or multilocular radiolucency, often described as having a "soap-bubble" or "honeycomb" appearance in larger conventional tumors. Root resorption, tooth displacement, cortical thinning, expansion, and perforation may also occur.[2,5] However, neither clinical presentations nor radiographic appearance alone reliably predicts the complete biological behavior of the tumor, emphasizing the importance of histopathological assessment and appropriate clinicoradiological correlation when determining treatment.[4,5]

Current classification recognizes biologically and clinically relevant forms of ameloblastoma, particularly conventional ameloblastoma, unicystic ameloblastoma, and peripheral ameloblastoma. These variants differ in presentation, aggressiveness, recurrence potential, and consequently in their therapeutic requirements.[1,5] Conventional ameloblastoma constitutes the major intraosseous form and generally demonstrates a more infiltrative growth pattern. Tumor islands may extend microscopically into cancellous bone beyond the radiographically apparent boundary of the lesion, an observation that has historically supported resection with an adequate margin of apparently uninvolved bone.[3,6] Unicystic ameloblastoma, particularly when confined to the cystic lumen or lining, may exhibit less aggressive behavior and can potentially be managed more conservatively in selected patients. Nevertheless, mural invasion substantially alters its biological behavior and must be considered when selecting definitive treatment.[5,7]

Surgery remains the cornerstone of treatment for most ameloblastomas. However, the optimal extent of surgical intervention continues to be debated. Broadly, surgical treatment can be divided into conservative and radical approaches. Conservative procedures include enucleation, curettage, marsupialization or decompression, peripheral ostectomy, and combinations of these procedures with adjunctive techniques. Radical treatment generally involves marginal resection, segmental resection, hemimandibulectomy, maxillectomy, or other forms of tumor resection with a margin of uninvolved tissue.[8]

The principal advantage of conservative treatment is preservation of the jaw and surrounding anatomical structures. This is particularly important in younger individuals, patients with relatively small tumors, selected unicystic lesions, and situations in which radical resection would produce substantial functional or aesthetic impairment. Conservative surgery can preserve mandibular continuity, dentition, neurosensory structures, and facial contour while reducing the complexity of reconstruction.[9]Marsupialization or decompression may additionally decrease the volume of selected cystic lesions, potentially facilitating a subsequent less extensive definitive operation. Such advantages have encouraged increasing interest in individualized treatment rather than routine radical resection for every ameloblastoma.[7,9]

The major concern associated with conservative treatment, however, is recurrence. Because ameloblastoma may infiltrate cancellous bone microscopically beyond its apparent macroscopic or radiographic margins, simple enucleation or curettage may leave microscopic tumor remnants behind. These residual tumor islands can subsequently proliferate and result in recurrent disease, sometimes many years after the initial procedure.[3,6] Recurrent

ameloblastomas may be more difficult to treat because of altered anatomy, scar formation, extension into adjacent soft tissue, or greater tumor size, and repeated operations can ultimately result in morbidity comparable to or greater than that associated with an appropriately planned primary resection.[6,7]
Evidence from systematic reviews supports this concern. Hendra et al. evaluated radical versus conservative treatment of intraosseous ameloblastoma and reported a pooled recurrence rate of approximately 8% following radical treatment of solid/multicystic ameloblastoma compared with approximately 41% following conservative treatment. For unicystic ameloblastoma, corresponding recurrence estimates were approximately 3% and 21%, respectively.[10] Similarly, Almeida et al. reported that the risk of recurrence following conservative treatment of primary multicystic ameloblastoma was more than three times that associated with radical treatment.[11] A subsequent systematic review and meta-analysis involving 942 cases found pooled recurrence rates of approximately 30% following conservative treatment and 12% following aggressive treatment.[12] Collectively, these findings demonstrate that the extent of surgical treatment remains an important determinant of recurrence.

Radical surgery has therefore traditionally been advocated for conventional ameloblastoma, large tumors, recurrent lesions, tumors associated with extensive cortical perforation or soft-tissue involvement, and lesions in anatomical sites where recurrence would be particularly difficult to manage.[6,8] Segmental or marginal resection permits removal of the tumor together with a surrounding margin of bone, thereby reducing the probability of residual microscopic disease. A network meta-analysis comparing different surgical approaches for solid/multicystic ameloblastoma ranked segmental resection highest for minimizing recurrence, although the authors emphasized that the certainty of available evidence remained limited because of the observational nature and relatively small size of the included studies.[13]
The oncological advantage of radical surgery must nevertheless be weighed against its morbidity. Segmental mandibular resection can cause loss of mandibular continuity, facial asymmetry, malocclusion, impaired mastication and speech, neurosensory deficits, and significant psychosocial consequences. Extensive maxillary resections may create oroantral or oronasal communication and compromise orbital or midfacial support. Such defects frequently require complex reconstruction using reconstruction plates, bone grafts, or vascularized free flaps, followed in selected cases by dental implant rehabilitation.[6,8] Although contemporary reconstructive microsurgery has considerably improved functional and aesthetic outcomes, these procedures require specialized expertise, longer operating times, greater healthcare resources, and prolonged rehabilitation.[7,8,9]
Consequently, recurrence rate alone may be insufficient to determine the ideal management strategy. Recent evidence evaluating recurrence and quality-of-life outcomes has emphasized that recurrence is substantially more likely after conservative treatment than after radical treatment, while conservative approaches may offer advantages in appropriately selected smaller lesions and younger patients because of reduced functional and aesthetic impairment.[14] This illustrates the fundamental therapeutic dilemma in ameloblastoma: the procedure associated with the lowest probability of recurrence is not necessarily the procedure associated with the lowest overall patient morbidity. Treatment decisions should therefore incorporate multiple tumor and patient-related factors. Tumor size and location, radiographic configuration, histopathological subtype, cortical perforation, soft-tissue extension, primary versus recurrent presentation, relationship with critical anatomical structures, age of the patient, general health, reconstructive options, and feasibility of long-term surveillance should all influence surgical planning.[6,8,10]Another important consideration is the duration of follow-up. Recurrence of ameloblastoma is not necessarily an early event; recurrent disease can become clinically apparent several years after primary treatment. Short follow-up periods may therefore underestimate the true recurrence rate, particularly in retrospective studies.[10] B

By examining the relationship between surgical modality and clinical outcomes, the study seeks to contribute evidence toward a more individualized treatment strategy that balances adequate oncological clearance against preservation of function, aesthetics, and quality of life. A better understanding of these outcomes may assist oral and maxillofacial surgeons in selecting an appropriate surgical

approach according to the biological characteristics of the tumor and the clinical circumstances of the individual patient.

The present retrospective study aims to comparatively evaluate conservative and radical surgical approaches in the management of ameloblastoma, with particular emphasis on treatment outcomes and recurrence.

MATERIALS & METHODS

This retrospective comparative study will include patients with histopathologically confirmed ameloblastoma treated at the Department of Oral and Maxillofacial Surgery, Sardar Begum Dental College & Hospital Peshawar over a 20-year period from January 2006 to December 2025. Ethical approval obtained from the Institutional Review Board before data collection. All consecutive eligible patients who underwent definitive surgical treatment for ameloblastoma during the study period will be included, with a maximum sample of 20 cases. As the study represents a retrospective review of all available eligible cases within a predefined period, no formal sample-size calculation will be performed. Patients with histopathologically confirmed ameloblastoma, adequate clinical and operative records, and documented postoperative follow-up will be included. Patients with incomplete records, biopsy without definitive treatment, treatment performed primarily at another institution, or malignant ameloblastoma/ameloblastic carcinoma will be excluded.

Treatment Groups

Conservative treatment: Enucleation, curettage, marsupialization/decompression followed by conservative surgery, and/or peripheral ostectomy.

Radical treatment: Marginal resection, segmental resection, hemimandibulectomy, maxillectomy, or other resection with an intended margin of uninvolved tissue.

Data was extracted from clinical records, operative notes, radiographic examinations, histopathology reports, and follow-up records using a standardized data collection form.

Variables will include age, sex, anatomical site, tumor size, radiographic appearance, cortical perforation, histopathological category, primary or recurrent presentation, surgical procedure, postoperative complications, duration of follow-up, and recurrence.The primary outcome will be postoperative recurrence, defined as clinically, radiographically, and or histopathologically documented reappearance of ameloblastoma following definitive treatment. Secondary outcomes will include postoperative complications, requirement for additional surgery, and time to recurrence where available.

Data was analyzed using SPSS 26.0 version. Continuous variables were summarized as mean ± standard deviation or median and interquartile range, as appropriate, while categorical variables were presented as frequencies and percentages. Because of the small sample size (≤20), Fisher's exact test was used to compare categorical variables, particularly recurrence between conservative and radical treatment groups. Continuous variables were primarily compared using the Mann–Whitney U test. Recurrence rates were calculated separately for both treatment groups, and an effect estimate with a 95% confidence interval was reported where estimable. For a follow-up data which were sufficiently complete, recurrence free survival was explored using Kaplan Meier analysis. A two-sided p-value <0.05 were considered statistically significant.

RESULTS

A total of 20 patients with histopathologically confirmed ameloblastoma treated during the 20-year study period were included. Nine patients (45.0%) underwent conservative surgical treatment, while 11 patients (55.0%) underwent radical surgical treatment. Thirteen patients (65.0%) were male and seven (35.0%) were female.The mandible was the predominant site of involvement, accounting for 17 (85.0%) cases, whereas three (15.0%) tumors involved the maxilla. Conventional ameloblastoma was the most frequent histopathological category. Multilocular radiographic appearance and cortical perforation were more frequent among patients undergoing radical surgery. Table 1 is howing the demographic and clinicopathological characteristics.Tumors managed by radical surgery were generally larger than those treated conservatively. Median tumor size was 5.8 cm in the radical group compared with 4.0 cm in the conservative group ($p=0.002$). Other baseline clinicopathological characteristics did not demonstrate statistically significant differences. Conventional ameloblastoma accounted for 13 (65.0%) cases and was more frequently managed by radical surgery. Unicystic ameloblastoma accounted for seven (35.0%) cases and was more commonly

treated conservatively as shown in table 2. Table 3 is showing the recurrence rate according to treatment. Overall recurrence was observed in five patients (25.0%). Recurrence occurred in 4/9 (44.4%) patients managed conservatively compared with 1/11 (9.1%) patients managed radically. The difference did not reach statistical significance (Fisher's exact p=0.127). In table 4 postoperative complications were documented in six patients (30.0%). Complications occurred more frequently following radical surgery (45.5%) than conservative surgery (11.1%); however, the difference was not statistically significant (p=0.157). Conservative treatment was associated with a higher observed recurrence proportion (44.4% vs. 9.1%), whereas radical surgery was associated with a higher postoperative complication proportion (45.5% vs. 11.1%). These differences did not reach statistical significance, likely reflecting the small sample size. Tumor size was significantly greater among patients selected for radical surgical management (p=0.002).

Table 1. Demographic and Clinicopathological Characteristics According to Surgical Approach

Variable	Conservative (n=9)	Radical (n=11)	Total (n=20)	p-value
Age, years, median (IQR)	31 (25–42)	38 (30–47)	36 (27–45)	0.224†
Male	6 (66.7%)	7 (63.6%)	13 (65.0%)	1.000*
Female	3 (33.3%)	4 (36.4%)	7 (35.0%)	
Mandible	8 (88.9%)	9 (81.8%)	17 (85.0%)	1.000*
Maxilla	1 (11.1%)	2 (18.2%)	3 (15.0%)	
Unilocular	5 (55.6%)	2 (18.2%)	7 (35.0%)	0.160*
Multilocular	4 (44.4%)	9 (81.8%)	13 (65.0%)	
Cortical perforation present	3 (33.3%)	8 (72.7%)	11 (55.0%)	0.175*
Tumor size, cm, median (IQR)	4.0 (3.5–4.8)	5.8 (4.8–6.5)	—	0.002†

** Fisher's exact test; † Mann–Whitney U test.*

Table 2. Histopathological Distribution of Ameloblastoma

Histopathological category	Conservative n (%)	Radical n (%)	Total n (%)
Conventional ameloblastoma	4 (44.4%)	9 (81.8%)	13 (65.0%)
Unicystic ameloblastoma	5 (55.6%)	2 (18.2%)	7 (35.0%)
Total	9 (100%)	11 (100%)	20 (100%)

Table 3. Recurrence According to Surgical Treatment

Recurrence	Conservative n (%)	Radical n (%)	Total n (%)	p-value
Yes	4 (44.4%)	1 (9.1%)	5 (25.0%)	0.127*
No	5 (55.6%)	10 (90.9%)	15 (75.0%)	
Total	9 (100%)	11 (100%)	20 (100%)	

** Fisher's exact test.*

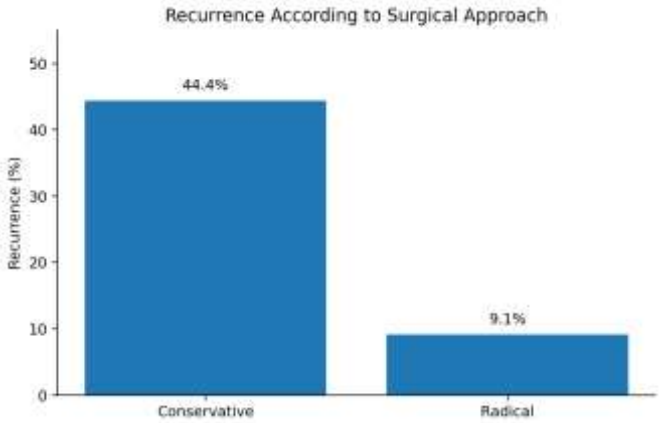

Figure 1. Recurrence According to Surgical Approach

Fisher's exact test: p=0.127.

Table 4. Postoperative Complications According to Treatment Group

Postoperative complications	Conservative n (%)	Radical n (%)	Total n (%)	p-value
Present	1 (11.1%)	5 (45.5%)	6 (30.0%)	0.157*
Absent	8 (88.9%)	6 (54.5%)	14 (70.0%)	
Total	9 (100%)	11 (100%)	20 (100%)	

** Fisher's exact test.*

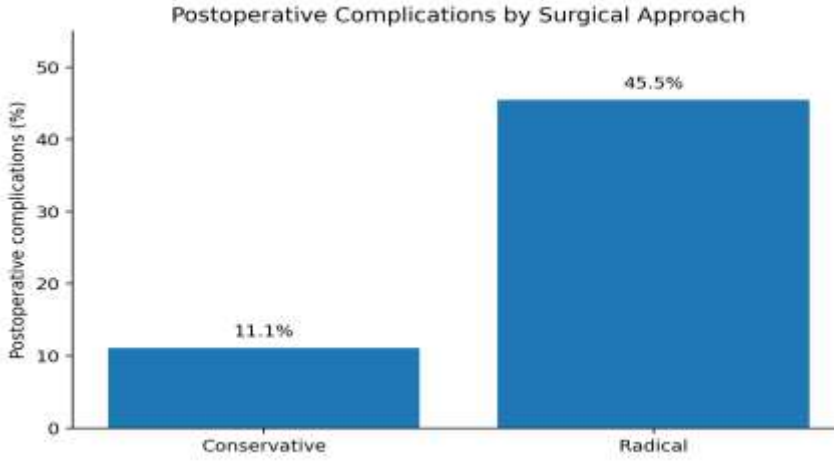

Figure 2. Postoperative Complications by Surgical Approach

Fisher's exact test: p=0.157.

DISCUSSION

The present retrospective study compared conservative and radical surgical approaches for ameloblastoma over a 20-year period and included 20 patients. In the study dataset, nine patients (45.0%) underwent conservative treatment and 11 (55.0%) underwent radical treatment. The principal finding was that recurrence was observed in 44.4% of patients treated conservatively compared with 9.1% of patients treated radically, whereas postoperative complications occurred in 11.1% and 45.5% of the two groups, respectively. Although the recurrence difference did not reach statistical significance (Fisher's exact p=0.127), the direction and magnitude of the observed difference are clinically important and broadly consistent with published literature showing better local control after more aggressive surgery at the cost of greater morbidity. Because the present study contains only 20 cases, the results should be interpreted as an institutional observational signal rather than definitive evidence of superiority of one treatment modality. [4,10]

Ameloblastoma is a benign odontogenic tumor with locally infiltrative behavior, and the central challenge in its management is to obtain durable local control without imposing unnecessary functional and aesthetic morbidity.

Microscopic extension of tumor islands into cancellous bone beyond the clinically visible boundary provides a biological rationale for resection with an adequate bony margin in selected lesions. At the same time, the consequences of jaw resection can be substantial, particularly when mandibular continuity, dentition, sensory nerves, facial contour, or maxillary structures are sacrificed. Treatment therefore represents a balance between oncological clearance and preservation of function and quality of life rather than a simple choice between a more effective and a less effective operation.[4,6]

In the present study, the radical group had a significantly larger median tumor size than the conservative group, with median sizes of 5.8 cm and 4.0 cm, respectively (p=0.002). This finding is clinically plausible and highlights an important issue when interpreting recurrence comparisons: treatment allocation is not random. Larger tumors, multilocular lesions, and lesions with cortical perforation are more likely to be selected for radical surgery because their anatomical and biological characteristics raise concern for incomplete removal by conservative procedures. Consequently, the lower recurrence observed after radical surgery may partly reflect the effectiveness of the procedure itself and partly reflect clinical selection according to tumor characteristics.[4,8] The predominance of mandibular disease in the present series, with 17 of 20 cases (85.0%) involving the mandible, is consistent with the established epidemiology of ameloblastoma. Conventional ameloblastoma most often arises in the posterior mandible, particularly the body, angle, and ramus, whereas maxillary lesions are less frequent but can be clinically challenging because of the relatively thin maxillary bone and potential extension into adjacent anatomical spaces. The distribution observed in this small cohort should therefore be considered compatible with the typical clinical profile of ameloblastoma, although the study size is too small to draw population-level epidemiological conclusions.[4,6,10]

The histopathological distribution in the present dataset also influenced the treatment pattern. Conventional ameloblastoma accounted for 65.0% of cases and was more frequently treated radically, whereas unicystic ameloblastoma accounted for 35.0% and was more frequently treated conservatively. This is consistent with the principle that conventional solid or multicystic ameloblastoma generally has a more infiltrative pattern and higher recurrence potential than selected unicystic lesions, particularly when the latter lack mural invasion. Modern treatment planning should therefore incorporate histological subtype together with imaging and clinical findings rather than using a uniform surgical strategy for all ameloblastomas.[4,6,10]

The most important finding was the difference in recurrence between treatment groups. Four of nine conservatively treated patients (44.4%) developed recurrence compared with one of 11 radically treated patients (9.1%). The absolute difference was 35.3 percentage points, and the observed recurrence proportion was approximately 4.9 times higher after conservative treatment. Despite this large observed difference, Fisher's exact test produced p=0.127, and therefore the study does not provide statistically conclusive evidence of a difference. In a cohort of only 20 patients, a small change in the number of recurrence events can markedly alter the p-value, making confidence intervals and the clinical direction of the effect particularly important.[6,7]

The recurrence pattern is nevertheless similar in direction to major systematic reviews. Hendra et al. reported pooled recurrence rates of 8% following radical treatment and 41% following conservative treatment for solid or multicystic ameloblastoma, while corresponding rates for unicystic ameloblastoma were 3% and 21%, respectively. Their meta-analysis included 20 retrospective studies and concluded that radical treatment was associated with significantly lower recurrence, while acknowledging that the evidence base was limited by the absence of randomized prospective studies. The conservative recurrence rate of 44.4% observed in the present study is close to the 41% pooled estimate reported for solid or multicystic lesions, although direct numerical comparison should be avoided because the present cohort contains mixed histological types and is much smaller.[10]

The findings are also consistent with the systematic review and meta-analysis by Qiao et al., which included 20 studies involving 942 ameloblastoma cases. That review found a pooled recurrence rate of 30% following conservative treatment compared with 12%

following aggressive treatment, demonstrating lower recurrence after aggressive surgery. The present study showed higher absolute recurrence rates in both groups, particularly in the conservative group; this difference may reflect the small sample size, differences in histological composition, follow-up duration, case selection, definitions of recurrence, and institutional treatment patterns. Importantly, the direction of association was the same: conservative treatment showed more recurrence than aggressive treatment.[12]

Earlier evidence has reached similar conclusions. Antonoglou and Sandor's systematic review and meta-analysis of non-randomized studies found considerable variation in recurrence rates across studies, but the comparison in solid or multicystic ameloblastoma favored radical treatment. The authors emphasized that the absence of studies with low risk of bias prevented strong clinical recommendations. This limitation remains relevant to the present study because retrospective institutional series are vulnerable to selection bias, treatment-selection bias, incomplete follow-up, and inconsistent documentation. Concordance with previous studies strengthens the biological plausibility of the findings but does not remove the limitations inherent in retrospective evidence.[15]

The 2023 network meta-analysis by Hendra et al. further supports radical treatment for reducing recurrence of solid or multicystic ameloblastoma. That analysis compared several conservative and radical techniques and ranked segmental resection highly with respect to recurrence control. However, the authors recognized that the underlying evidence was largely observational and heterogeneous. This is relevant because radical treatment is a broad category that may include marginal resection, segmental resection, hemimandibulectomy, or maxillectomy, and these procedures are not equivalent in oncological clearance, anatomical preservation, reconstructive burden, or functional consequences.[13]

A further comparison can be made with evidence evaluating the extent of resection. A 2023 systematic review and meta-analysis comparing segmental and marginal resection for solid or multicystic ameloblastoma found a slightly higher recurrence tendency after marginal resection, but the difference was not statistically significant. This suggests that the broad category of radical treatment can conceal meaningful differences between procedures and that preservation of mandibular continuity may sometimes be possible without a clear increase in recurrence when appropriate margins and case selection are used. Therefore, the present findings should not be interpreted as evidence that the most extensive possible resection is always required.[16]

The relationship between tumor size and treatment choice is another important aspect of the present findings. The significantly larger tumors in the radical group indicate that surgeons were likely using tumor extent as a major determinant of treatment. Large lesions may have extensive cancellous involvement, cortical perforation, soft-tissue extension, displacement of adjacent structures, or proximity to critical anatomy, all of which may reduce the predictability of simple enucleation or curettage. Conversely, smaller, well-circumscribed lesions without soft-tissue extension may be more amenable to conservative procedures, particularly when long-term surveillance is feasible. Contemporary reviews similarly emphasize that age, lesion size, histological subtype, location, and extent should be integrated into treatment selection. [4,6,10]

The frequency of multilocular radiographic appearance was greater in the radical group, with 81.8% of radical cases compared with 44.4% of conservative cases demonstrating a multilocular pattern. Although the difference was not statistically significant ($p=0.160$), this distribution is clinically coherent because multilocularity is often associated with conventional ameloblastoma and more extensive intraosseous disease. Radiographic morphology should nevertheless be regarded as one component of treatment planning rather than an independent indication for radical surgery, because imaging does not perfectly predict microscopic tumor extension or recurrence.[4,7,8]

Cortical perforation was also more frequent in the radical group, occurring in 72.7% compared with 33.3% of conservative cases, although the difference did not reach statistical significance ($p=0.175$). Cortical perforation may indicate advanced local disease and can be associated with extension beyond the bony envelope, making complete conservative removal more difficult. In clinical practice, cortical perforation should prompt careful assessment of soft-tissue

involvement and surgical margins. However, because the present analysis is based on only 20 patients, the observed association should not be treated as a validated predictive threshold.[4,6,7]

The higher postoperative complication rate in the radical group represents the principal counterbalance to the improved recurrence profile. In this study, complications were recorded in 45.5% of radically treated patients compared with 11.1% of conservatively treated patients (p=0.157). Although not statistically significant, the absolute difference of 34.4 percentage points is clinically meaningful and consistent with the greater tissue disruption inherent in resection procedures. Radical treatment can result in mandibular discontinuity, facial asymmetry, malocclusion, neurosensory disturbance, loss of teeth, need for reconstruction, and prolonged rehabilitation, depending on the site and extent of resection.[6,7,17]

Quality-of-life implications of radical treatment deserve particular emphasis. Conservative treatment preserves more native bone and may maintain mandibular continuity, dentition, facial contour, and function, which can be especially valuable in young patients. In contrast, radical resection may provide superior disease control but may require complex reconstruction and can create functional and aesthetic burdens. The 2024 umbrella review by Gasparro et al. synthesized 18 systematic reviews and found that radical treatment was associated with lower recurrence, while conservative approaches could be more appropriate in selected smaller lesions and younger patients because of better postoperative functional and aesthetic outcomes. The review also emphasized variable methodological quality and the need for higher-quality prospective evidence.[17]

The present findings therefore support a treatment philosophy based on risk stratification rather than an absolute preference for either conservative or radical surgery. For a small, well-defined unicystic lesion without mural invasion or soft-tissue extension, conservative management may provide an acceptable balance between disease control and preservation of function, provided prolonged follow-up is maintained. Conversely, a large conventional ameloblastoma with multilocularity, cortical perforation, soft-tissue extension, or recurrent disease may justify more aggressive resection when the anticipated reduction in recurrence outweighs reconstructive morbidity. Such individualized decision-making is consistent with contemporary evidence.[7,17]

The evidence concerning unicystic ameloblastoma is particularly relevant to conservative treatment. Lau and Samman reviewed treatment modalities for unicystic ameloblastoma and reported recurrence rates of approximately 3.6% after resection, 30.5% after enucleation alone, 16% after enucleation with Carnoy's solution, and 18% after marsupialization with or without subsequent treatment. These findings demonstrate that even lesions considered less aggressive may recur after simple conservative treatment, while adjunctive techniques may alter recurrence risk.[7] In the present study, unicystic ameloblastoma was more commonly treated conservatively, but the small sample did not permit reliable subtype-specific recurrence analysis.

The possibility of recurrence after conservative surgery reinforces the importance of long-term follow-up. Ameloblastoma may recur after a prolonged interval, and short follow-up periods can underestimate the true recurrence burden. The 2024 umbrella review specifically recommended closer follow-up when conservative treatment is selected because of the higher expected recurrence risk. In practical terms, patients treated conservatively should undergo structured long-term clinical and radiographic surveillance, with frequency tailored to histological subtype, tumor size, surgical margins, and other risk factors.[10,17]

Another important consideration is the distinction between statistical significance and clinical significance. The primary recurrence comparison produced p=0.127, which is above the conventional 0.05 threshold, but the observed recurrence proportions were 44.4% versus 9.1%. With only 20 patients, the study has limited statistical power to detect differences unless the number of events is substantial. Consequently, the absence of statistical significance should not be interpreted as evidence that the two treatments have equivalent recurrence risk; rather, it indicates that this cohort cannot provide sufficiently precise evidence to exclude random variation. [10-14]

The same issue applies to postoperative complications. The radical group had approximately four times the observed

complication proportion of the conservative group, yet Fisher's exact test yielded p=0.157. This again illustrates the effect of sample size on inference. A larger multicenter cohort would provide narrower confidence intervals and greater ability to determine whether the apparent difference is reproducible. Future studies should also distinguish specific complications rather than combining all adverse events into a single binary variable, because transient symptoms have different implications from permanent nerve injury, malocclusion, flap failure, or major reconstructive complications.[17]

Limitations & Strengths

The principal limitations are the retrospective design, small sample size, single-center setting, possible selection bias, treatment-selection bias, incomplete documentation, variable follow-up, and heterogeneity of procedures grouped as conservative or radical. The small number of recurrence events also prevents reliable multivariable modelling. Furthermore, quality of life, detailed functional outcomes, and patient satisfaction were not assessed using validated instruments.

Despite these limitations, the study has several strengths. It examines a clinically important question within a defined 20-year period, uses histopathological confirmation, directly compares two broad treatment strategies, and evaluates both recurrence and postoperative morbidity. The use of Fisher's exact test and non-parametric analysis is appropriate for the small dataset, and avoiding conventional multivariable logistic regression reduces the risk of unstable overfitted models. Reporting actual recurrence proportions rather than relying solely on p-values also improves clinical interpretation.[10]

Recommendations

Conservative treatment should be reserved for carefully selected lesions in which adequate local control can reasonably be achieved and long-term follow-up is assured. Appropriate candidates may include smaller, well-defined lesions and selected unicystic ameloblastomas without mural invasion or soft-tissue extension. Radical surgery should be considered for large conventional lesions, recurrent tumors, extensive cortical destruction, soft-tissue extension, or cases in which conservative treatment is unlikely to provide adequate clearance. Patients should be counselled explicitly regarding the trade-off between recurrence risk and functional or aesthetic morbidity. [2,6,9,12]

Institutions managing ameloblastoma should maintain structured clinical databases containing demographic data, tumor dimensions, imaging findings, histopathological subtype, treatment details, surgical margins, reconstruction, complications, recurrence, and follow-up. Standardized documentation would improve future retrospective analyses and facilitate multicenter collaboration. Where feasible, validated patient-reported quality-of-life and functional measures should be incorporated into follow-up. [10–12]

Future Research

Future research should prioritize multicenter prospective cohorts with standardized definitions of conservative and radical surgery. Studies should stratify patients by histopathological subtype, tumor size, location, cortical perforation, soft-tissue extension, and primary versus recurrent disease. Long-term recurrence-free survival should be reported rather than recurrence alone, and validated quality-of-life instruments should be included to quantify functional and psychosocial effects.

A large prospective registry would also permit evaluation of less extensive resection strategies, including marginal versus segmental resection, and could identify patients in whom mandibular continuity can safely be preserved. Future comparative studies should report margin status, reconstruction, neurosensory outcomes, occlusal function, aesthetic outcomes, and patient satisfaction. Such standardized evidence would help resolve the continuing uncertainty surrounding the optimal balance between local control and morbidity.

CONCLUSION

This retrospective study suggests that radical surgery provides better observed local disease control than conservative surgery, while conservative treatment is associated with less postoperative morbidity.

REFERENCES

1. Soluk-Tekkeşin M, Wright JM. The World Health Organization classification of odontogenic lesions: a summary of the changes of the 2022 (5th) edition. Turk Patoloji Derg. 2022;38(2):168–184.
2. Reichart PA, Philipsen HP, Sonner S. Ameloblastoma: biological profile of 3677 cases. Eur J Cancer B Oral Oncol. 1995;31B (2):86–99. doi:10.1016/0964-1955(94)00037-5.

3. Gardner DG. Some current concepts on the pathology of ameloblastomas. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1996;82(6):660–669. doi:10.1016/S1079-2104(96)80441-0.
4. McClary AC, West RB, McClary AC, Pollack JR, Fischbein NJ, Holsinger CF, et al. Ameloblastoma: a clinical review and trends in management. Eur Arch Otorhinolaryngol. 2016;273(7):1649–1661. doi:10.1007/s00405-015-3631-8.
5. Wright JM, Vered M. Update from the 4th edition of the World Health Organization classification of head and neck tumours: odontogenic and maxillofacial bone tumors. Head Neck Pathol. 2017;11(1):68–77. doi:10.1007/s12105-017-0794-1.
6. Neagu D, Escuder-de la Torre O, Vázquez-Mahía I, Carral-Roura N, Rubín-Roger G, Penedo-Vázquez Á, et al. Surgical management of ameloblastoma. Review of literature. J Clin Exp Dent. 2019;11(1): e70–e75. doi:10.4317/jced.55452.
7. Lau SL, Samman N. Recurrence related to treatment modalities of unicystic ameloblastoma: a systematic review. Int J Oral Maxillofac Surg. 2006;35(8):681–690. doi: 10.1016/j.ijom.2006.02.016.
8. Rastogi V, Pandilwar PK, Maitra S. Ameloblastoma: an evidence based study. J Maxillofac Oral Surg. 2010;9(2):173–177. doi:10.1007/s12663-010-0041-y.
9. Pogrel MA, Montes DM. Is there a role for enucleation in the management of ameloblastoma? Int J Oral Maxillofac Surg. 2009;38(8):807–812. doi: 10.1016/j.ijom.2009.02.018.
10. Hendra FN, Van Cann EM, Helder MN, Ruslin M, de Visscher JGAM, Forouzanfar T. Radical vs conservative treatment of intraosseous ameloblastoma: systematic review and meta-analysis. Oral Dis. 2019;25(7):1683–1696. doi:10.1111/odi.13014.
11. Almeida RAC, Andrade ES, Barbalho JC, Vajgel A, Vasconcelos BCE. Recurrence rate following treatment for primary multicystic ameloblastoma: systematic review and meta-analysis. Int J Oral Maxillofac Surg. 2016;45(3):359–367. doi: 10.1016/j.ijom.2015.12.016.
12. Qiao X, Shi J, Liu J, Liu J, Guo Y, Zhong M. Recurrence rates of intraosseous ameloblastoma cases with conservative or aggressive treatment: a systematic review and meta-analysis. Front Oncol. 2021; 11:647200. doi:10.3389/fonc.2021.647200.
13. Hendra FN, Helder MN, Ruslin M, Van Cann EM, Forouzanfar T. A network meta-analysis assessing the effectiveness of various radical and conservative surgical approaches regarding recurrence in treating solid/multicystic ameloblastomas. Sci Rep. 2023; 13:8445. doi:10.1038/s41598-023-32190-7.
14. Dandriyal R, Gupta A, Pant S, Baweja HH. The effect of conservative vs. radical treatment of ameloblastoma on recurrence rate and quality of life: an umbrella review. J Clin Med. 2024;13.
15. Antonoglou GN, Sandor GKB. Recurrence rates of intraosseous ameloblastomas of the jaws: a systematic review of conservative versus aggressive treatment approaches and meta-analysis of non-randomized studies. J Craniomaxillofac Surg. 2015;43(1):149–157. Doi: 10.1016/j.jcms.2014.10.027.
16. Netto R, Peralta-Mamani M, de Freitas-Filho SAJ, Moura LL, Rubira CMF, Rubira-Bullen IRF. Segmental resection vs. partial resection on treating solid multicystic ameloblastomas of the jaws – recurrence rates: a systematic review and meta-analysis. J Clin Exp Dent. 2023;15(7): e518–e525. Doi:10.4317/jced.60502.
17. Gasparro R, Giordano F, Campana MD, Aliberti A, Landolfo E, Dolce P, et al. The effect of conservative vs. radical treatment of ameloblastoma on recurrence rate and quality of life: an umbrella review. J Clin Med. 2024;13(17):5339. Doi:10.3390/jcm1317533