Frequency and Distribution of Radiolucent Jaw Lesions: A Retrospective Analysis of 9,723 Cases

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Abstract

Objectives: Practitioners should be aware of the occurrence rate and usual location of radiolucent jaw lesions. The aims of this study were to examine the frequency and location of radiolucent jaw lesions, including apical granulomas, apical cysts, keratocystic odontogenic tumors (KOTs), central giant cell lesions (CGCLs), ameloblastomas, and metastatic lesions, that were submitted for biopsy along with associated demographics.

Methods: Biopsy diagnoses from 9,723 lesions (submitted between 1992 and 2006) were included in this study. Data on lesion location as well as patient demographics were evaluated. Results: Thirty types of radiolucent jaw lesions were classified. Nonhealing apical granulomas (40.4%) and cysts (33.1%) occurred at similar rates and together totaled 73% of all biopsied lesions. The majority of reported granulomas and cysts occurred in the anterior maxilla (>36% in each category). The frequency of KOTs (8.8%), CGCLs (1.3%), ameloblastomas (1.2%), and metastatic lesions (<1%) are to be noted along with their location, which was predominately in the posterior mandible. The occurrence of apical cysts, ameloblastomas, KOTs, and metastatic lesions were seen slightly more in men, at 56%, 54%, 55%, and 68%, respectively. The occurrence of CGCLs was seen slightly more in women at 56%, whereas apical granulomas were equally present in men and women. Conclusions: Most nonhealing lesions submitted for biopsy were classified as granulomas or cysts (73%) often from the anterior maxillary jaw. Nonhealing radiolucent jaw lesions other than granulomas or cysts were reported over 20% of the time and may have more severe pathological implications, suggesting the value of differential diagnoses.

Materials and Methods

This study was approved by the University of Minnesota’s Institutional Review Board. All biopsy reports from submitted radiolucent lesions of the jaw at the Department of Oral Pathology, University of Minnesota School of Dentistry within the timeframe of January 1, 1992, to December 31, 2006, were examined. Lesions that were on the ramus or angle of the mandible were excluded. Inclusion of all other radiolucent lesions associated with the jaw contained 30 types of radiolucent jaw lesions, totaling 9,723 lesions (Fig. 1). Demographics evaluated included the location of the lesion; sex; and ethnicity for apical granulomas and cysts, KOTs, CGCLs, ameloblastomas, and metastatic lesions. Age was estimated by subtracting the patient’s year of birth from the year of the biopsy for KOTs, CGCLs, ameloblastomas, and metastatic lesions.

Associated tooth numbers of each lesion were recorded, and the location was classified as either anterior or posterior within the jaws. Lesions that spanned anterior-posteriorly were placed into the location that had more teeth associated with the lesion.
When a lesion was equally placed between a canine and a premolar, it was recorded in the respective posterior location.

**Results**

Figure 1 shows the distribution of the 9,723 reported radiolucent jaw lesions. Apical cysts (3,215) and apical granulomas (3,931) together comprised 73% of the radiolucent lesions we considered. Eight hundred fifty-seven (8.8%) KOTs, 129 (1.3%) CGCLs, 114 (1.2%) ameloblastomas, and 25 (0.3%) metastatic lesions were reported. Two (0.02%) incidences of squamous odontogenic tumor and chondrogenic sarcoma were reported, and 1 (0.01%) incidence of Stafne bone cyst was reported. Also, cases of nasopalatine duct cysts, residual cysts, lateral periodontal cysts, neurofibromas, traumatic bone cysts, odontogenic fibromas, cemento-osseous dysplasias, mucopolysaccharidosis carcinomas, ossifying fibromas, keratinizing odontogenic cysts, calcifying odontogenic cysts, malignant lymphomas, odontogenic myxomas, schwannomas, adenomatoid odontogenic tumors, osteoporotic bone marrow defects, Langerhans cell disease, plasmacytomas, osteogenic sarcomas, cherubism, and globulomaxillary cysts were reported (Fig. 1).

The anterior maxilla was shown to be the most common site for cysts and granulomas, with an occurrence rate of 38% and 37%, respectively, but granulomas occurred more often in the posterior maxilla than cysts (ie, 35% vs 23%) (Fig. 2). In the posterior mandible, we report a greater incidence of cysts than granulomas (ie, 24% vs 15%, respectively). The least common biopsy location for both granulomas and cysts within the jaws was the anterior mandible, with 8% and 11%, respectively, in this location. Six percent of granulomas and 5% of cysts had an unreported location within the jaws.

Four hundred eighty-nine (57%) of the KOT lesions were located in the posterior mandible (Fig. 3). The anterior mandible was the least common location for KOTs, with 60 (7%) reported. Of the 129 CGCLs, 56 (43%) cases occurred in the posterior mandible, 28 (22%) in the anterior mandible, 22 (17%) in the anterior maxilla, and 11 (9%) in the posterior maxilla; 12 (9%) case locations were unreported. We report 67 (59%) ameloblastomas in the posterior mandible, 11 (10%) in the anterior mandible, 15 (13%) in the posterior maxilla, and 2 (1.7%) in the anterior maxilla; 18 (23%) cases did not list the location. Three (12%) of the 25 metastatic lesions were located in the posterior maxilla, and 20 (80%) were in the posterior mandible.

The occurrence of cysts, ameloblastomas, KOTs, and metastatic lesions was seen slightly more often in men (ie, 56%, 55%, 55%, and 68%, respectively). The occurrence of CGCLs was seen slightly more in women (ie, 56%). Apical granulomas were almost equally present in men and women (ie, 49% vs 51%, respectively) (Fig. 4).

The average ages for ameloblastomas, CGCLs, KOTs, and metastatic lesions were 46, 35, 46, and 63 years old, respectively. Lesions were
reported in children as young as 13 for ameloblastomas, 17 for CGCLs, 5 for KOTs, and 17 years of age for metastatic lesions; the oldest patient age on biopsy reports for these lesions was 94 years of age or older (Table 1).

Over 90% of the reported apical granulomas, apical cysts, CGCLs, and KOTs occurred in Caucasians; 5% to 7% of the reported incidences for these lesions had an unreported ethnicity. Of the reported ameloblastomas, 79% occurred in Caucasians, 6% in Blacks, 3% in Asians, 2% in other ethnicities, and 10% had an unreported ethnicity. Twenty-two (88%) metastatic lesions were reported in Caucasians, 1 (4%) in a Native American, and 2 (8%) reports had unstated ethnicities.

Discussion

Sommer et al (23) showed a greater incidence of granulomas when compared with cysts (84% vs 6%). Another study by Lalonde and Luebke (24) analyzed 800 granulomas and cysts and reported the incidence to be 45.2% and 43.5%, respectively. A recent retrospective study of 4,983 radiolucent lesions found a 59.7% incidence of peri-apical granulomas with a 29.2% incidence of radicular cysts (25). The current study found a 40.4% incidence of apical granulomas and a 33.1% incidence of apical cysts. Many studies suggest apical granulomas and cysts occur more frequently in the maxilla than in the mandible, with the most commonly affected teeth being the maxillary lateral and central incisors. Lalonde and Luebke (24) reported 56% of granulomas and cysts to be in the maxilla, 38% in the mandible, and 6% in unknown locations, with 53% of granulomas and cysts reported in women and 46% in men. We report 68% of granulomas and cysts to be in the maxilla, 29% in the mandible, and 3% in unknown locations, with 48% of the granulomas and cysts occurring in women and 52% in men.

Rosenberg et al (17) suggested that discrepancies in the frequencies of granulomas and cysts arise from how oral pathologists differentially classify cysts. Some pathologists classify a lesion as a cyst only if the whole lumen is lined by epithelium, whereas others consider a partially epithelial-lined lumen enough to diagnose the lesion as a cyst (17). In this study, we examined for reporting differences in classification or reporting numbers over the 15-year time period between the 3 different oral pathologists and found no significant differences.

According to Brannon (2), 65% of 292 KOTs were in the mandible and 35% were in the maxilla. KOTs occurred 56% of the time in men and 42% in women in the study. Our results strongly correlate with Brannon’s study for both location and sex. We report 68% of KOT lesions in the mandible, 31% in the maxilla, and 1% in unreported locations. Fifty-five percent of KOT lesions occurred in men and 45% in women in our study.

Table 1. Reported Ages of Ameloblastomas, CGCLs, KOTs, and Metastatic Lesions

<table>
<thead>
<tr>
<th>Lesion Type</th>
<th>Minimum Age</th>
<th>Maximum Age</th>
<th>Average Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ameloblastomas</td>
<td>13</td>
<td>94</td>
<td>46</td>
</tr>
<tr>
<td>CGCLs</td>
<td>7</td>
<td>97</td>
<td>35</td>
</tr>
<tr>
<td>KOTs</td>
<td>5</td>
<td>100</td>
<td>46</td>
</tr>
<tr>
<td>Metastatic</td>
<td>17</td>
<td>98</td>
<td>62</td>
</tr>
</tbody>
</table>

The minimum reported ages were 13, 7, 5, and 17 for ameloblastomas, CGCLs, KOTs, and metastatic lesions, respectively. The maximum reported ages were 94, 97, 100, and 98 for ameloblastomas, CGCLs, KOTs, and metastatic lesions, respectively. n = 109, 125, 840, and 25 for ameloblastomas, CGCLs, KOTs, and metastatic lesions with reported information for estimating ages, respectively.
The literature suggests that CGCLs occur more frequently in women and are more common in the mandible (3–6). This study reports 56% of CGCLs were in women, with 70% of CGCLs located in the mandible and 28% located in the maxilla. Lange and Van Den Akker (3) and Whitaker and Waldron (4) showed CGCLs in the maxilla to be mostly in the anterior region, whereas in the mandible the lesions are equally distributed between the anterior and posterior jaws. We report 67% of the mandibular CGCLs were in the posterior region and 33% in the anterior region.

Previous studies have shown ameloblastomas to be more common in the mandible, ranging from 78% to 87% (7, 8, 26). Previous reports show no significant sex predilection (24), for which our results aligned. Neville et al (26) report 7% of ameloblastomas to be in the posterior maxilla, 6% in the anterior maxilla, 10% in the anterior mandible, and 78% in the posterior mandible. We report 13%, 2%, 10%, and 59% for those respective locations. Nineteen (17%) of our 114 ameloblastomas were not recorded into specific jaw positions.

Metastatic lesions in the jawbones occur in the mandible over 80% of the time (9, 10). We report that 80% of the metastatic lesions were located in the mandible and 20% of these lesions were in the maxillary jaw. Previous literature suggests that these tumors occur similarly in women (39%–52%) and men (48%–50%) (9, 10). Of our 25 reported metastatic lesions, 68% occurred in men and 32% occurred in women.

Conclusions

Interpretation of the radiograph is subjective (27), whereas biopsy is the definitive diagnostic tool, especially in light of recent case reports (28–31). Most of the nonhealing radiolucent lesions submitted for biopsy were either apical granulomas (40.4%) or apical cysts (33.1%), and they were often from the maxillary anterior jaw. Over 20% of the reported nonhealing radiolucent lesions submitted had a more severe pathologic implication, such as KOTs (8.8%), CGCLs (1.3%), ameloblastomas (1.2%), and even the small but important number of metastatic lesions (0.26%), with most of these lesions being located in the posterior mandible. Age should not be a detriment for biopsy, and lesions were submitted from patients as young as 5 years old to 100 years old. Differential diagnoses must be considered to allow proper treatment of patients.

Dentists should be aware of abnormal radiolucent or radiopaque areas in the jaws. Radiopaque lesions are rarely cause for immediate alarm, whereas many benign and malignant processes appear as radiolucent lesions in the jaws. These can range from a simple bone marrow defect to a primary malignancy or metastatic tumor in the jaw. There are numerous examples of serious pathologic conditions or malignancies masquerading as a nonhealing apical lesion.

Acknowledgments

The authors deny any conflicts of interest related to this study.

References