Endodontics

CLINICAL, BOENTGENOLOGIC, AND HISTOPATHOLOGIC FINDINGS IN TEETH WITH APICAL RADIOLUCENT AREAS

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IN THE treatment of periapical lesions, it has been assumed for many years that a differential diagnosis between various lesions could be made on the basis of roentgenologic studies of the diseased areas. Recently a number of controversial reports have appeared, questioning the value of the roentgenogram as a means of making differential diagnoses of radiolucent areas at tooth apices. These investigators called attention to the discrepancies between the clinical and roentgenographic diagnoses on the one hand, and the histopathologic diagnoses of resected periapical lesions on the other.

In 1939, Kronfeld¹ stated: "A comparison of the radiographs in chronic periodontitis with the corresponding tissue sections indicates that with the exception of very advanced stages, it is impossible to distinguish radiographically between solid granuloma, apical abscess and radicular cyst." Recently, Sommer² made essentially the same observation: "How can we distinguish a granuloma from a cyst by means of a roentgenogram? The answer to this question has been partially furnished by the information gained from the pathologic findings. Our findings have not demonstrated that epithelial proliferation occurs as frequently as has been supposed." Failure of correlation between roentgenographic and microscopic diagnoses of periapical lesions was also demonstrated by Blum³ in a thorough study of nine cases. However, the specialist best prepared to see the potentialities as well as the limitations of roentgenograms, L. M. Ennis,⁴ sounded his considered warning: "One must appreciate the limitations of the roentgenogram in the field of diagnosis. There are conditions in which the roentgenogram, even in the hands of the specialist, can accomplish little more than confirm or deny the tentative conclusions derived by other methods. Indeed, the roentgenogram may be wholly unavailable for purposes of diagnosis in some situations and conditions." One of these "situations and conditions" is the cyst, which can be distinguished from a noncystic lesion only by microscopic diagnosis.

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Furthermore, as emphasized by Boyle,⁵ "The possibility of differences in density of the bone shadow being due to conditions other than infection or cyst formation must always be kept in mind. Paget's disease of bone, fibrous dysplasia of bone, eosinophilic granuloma, Schüller-Christian's disease, and neoplasms of either local or metastatic origin are among the conditions which must be considered in a differential diagnosis."

The first systematic attempt to establish the usefulness of roentgenograms in determining periapical disease was made by Sommer,² who, in a comparative study of eighteen specimens from either root resection or apical curettement, set out to determine "to what extent the roentgenogram can be relied upon as a diagnostic aid in determining the bacteriologic and histopathologic status of radiolucent areas." His findings show that neither the presence of periapical radiolucent areas nor their size or shape indicates existence of infection, virulence of organisms, if present, or the resistance of the patient. With regard to microscopic examinations, he states: "The histopathologic findings do not agree with the roentgenographic appearance of a periapical bone lesion in most instances." He therefore warns dentists not to remove teeth with periapical areas on roentgenographic evidence alone.

In 1954, Priebe, Lazansky, and Wuehrmann⁶ reported on a study of 101 cases in which both roentgenographic and histopathologic diagnoses were made. They conclude that "the roentgenograms should be used *only* as a method of *locating* areas of apical change, and *not* as a means of differentiating between them" (italics ours).

The study reported in this article was undertaken with a view to adding another check on the value of diagnosis of periapical lesions.

Following the example of Priebe and his associates,⁶ we treated chronic alveolar abscesses and granulomas as one group and all cysts as another group. An attempt was then made to differentiate one group from the other. The reason for this arbitrary grouping is a practical one, since teeth with associated abscesses or granulomas generally respond to conservative endodontic treatment, while cysts are thought to require surgical removal.

The material reported upon was secured from 121 teeth which had undergone root resection or periapical curettage. The clinical diagnoses, based upon the examination of the patients and of the roentgenograms, were made by a member of the Endodontic Department and reviewed by the head of that department. The resected periapical tissue, together with the root apex, was sent to the Department of Histopathology for microscopic study and diagnosis. The resultant diagnosis was made independently of the clinical data and roentgenograms.

The criteria used for making these differential diagnoses are in accordance with the following definitions:

Cyst: A pathologic cavity with an epithelial-lined lumen which contains either a fluid or semisolid substance (Fig. 1).

Granuloma: Chronic inflammatory tissue which has replaced the periodontal membrane and areas of alveolar bone (Fig. 2). Not too uncommon are granulomas containing proliferated epithelium which arises from the residual epithelial cells of Malassez in the periodontal membrane. Such epithelium-containing granulomas should not be confused with dental cysts (Fig. 3).



Fig. 1.—Radicular cyst. The roentgenogram shows a large round area of bone destruction. Upper cuspid; aged fifty-six years. *O*, Cyst cavity containing cholesterol; *F*, fibrous capsule; *NB*, trabeculae of new bone; *La*, *Li*, thin labial and lingual bone plates. (From Boyle: Kronfeld's Histopathology of the Teeth and Their Surrounding Structures, Lea & Febiger.)

Abscess: A central area containing purulent exudate surrounded by chronic inflammatory tissue which, in turn, is surrounded by a layer of fibrous connective tissue. It is distinguished from a dental cyst by the absence of an epithelial lining (Fig. 4).

Fig. 2.—Solid granuloma. Mesio-distal section through the root end of an upper lateral incisor with decomposed pulp and imperfect root canal filling. The roentgenogram of the specimen taken before decalcification is inserted in the lower right corner. Because of a slight apical curvature of the root, the root canal is visible only at the apical foramen. AB, alveolar bone; GT, granulation tissue occupying the space between alveolar bone and root; R, resorption of the root surface; PM, normal periodontal membrane. (From Boyle: Kronfeld's Histopathology of the Teeth and Their Surrounding Structures, Lea & Febiger.)

Fig. 3.—Granuloma with marked fibrous encapsulation. The roentgenogram shows a sharply circumscribed, punched-out defect in the otherwise very dense bone. A large amount of epithelium is present, which has a tendency to grow around the granulation tissue. Lower lateral incisor; aged forty-five years. G. Granulation tissue; E. epithelium; F. fibrous capsule surrounding the granuloma; CB, compact bone plate; PM, normal periodontal membrane. (From Boyle: Kronfeid's Histopathology of the Teeth and Their Surrounding Structure, Lea & Febiger.)



Fig. 2.



Fig. 3. (For legends, see opposite page.)

The roentgenograms of all 121 cases were then referred to the Department of Roentgenology for study and diagnosis. This department made its diagnosis entirely from the roentgenograms studied and without reference to the data from the Departments of Endodontics and Pathology.

Interpretation of the roentgenograms was based on the following criteria:

Cyst: "A circumscribed radiolucent area, usually more than $\frac{3}{8}$ inch in diameter, sharply outlined, bounded by a thin, even white line which represents a layer of cortical bone."

Granuloma (Fibrous type): "These areas have a definite radiolucent outline without the presence of a white line. They are usually less than 36 inch in diameter."

Abscess: "This type of lesion appears as a diffuse radiolucent area.""



Fig. 4.—Granuloma with central liquefaction. No epithelium is present. The roentgenogram shows a diffuse area of bone destruction above the apex of an upper central incisor. Age, fifty-two years. A. Apex; AC, abscess cavity containing pus cells; G, granulation tissue; F, fibrous tissue; B, bone trabeculae. (From Boyle: Kronfeld's Histopathology of the teeth and Their Surrounding Structures, Lea & Febiger.)

Size of lesion as shown in the roentgenogram was omitted as a criterion of classification. In this omission, Ennis,^a who offers essentially the same distinction and definitions as McCall and Wald,⁷ was followed, because he does not restrict any one of these lesions to a fixed size.

It was the basic assumption of this study that the diagnosis by the Pathology Department through the microscopic study of the biopsy sections must be the definitive one, for it is the present-day consensus that the histopathologic findings are the last court of appeal for the determination of the disease state, since the basis of all disease is cellular or cytochemical. Of the 121 cases studied, the findings were as follows:

The microscopic examination and diagnosis by the Department of Pathology showed that thirty-two cases were cysts and eighty-nine were granulomas or abscesses.

The Endodontic Department, whose conclusions were based upon the examination of the patients and of the roentgenograms, diagnosed sixteen (50 per cent) of the 32 cysts correctly and sixteen (50 per cent) incorrectly. Of the eighty-nine cases of granulomas and abscesses, sixty-one (68.5 per cent) were diagnosed correctly and twentyeight (31.5 per cent) incorrectly.

The Roentgenologic Department, whose interpretations were based upon the roentgenographic examination alone, diagnosed fourteen (44 per cent) of the cysts correctly and eighteen (56 per cent) incorrectly. Of the granulomas, sixty-one (68.5 per cent) were diagnosed correctly and twenty-eight (31.5 per cent) incorrectly.

The above figures were then submitted for statistical analysis and evaluation. The chi-square test of association was applied, with the following results:

For the Endodontic Department, χ^2 was found to be equal to 2.74. Since this is less than the 5 per cent level (actually, P = 0.10), the hypothesis that there is no association between the diagnoses of the Endodontic Department and those of the Department of Pathology cannot be rejected. The data suggest that there is only chance association between the two types of diagnoses.

For the Roentgenology Department, χ^2 was found to be equal to 0.043. The probability corresponding to this χ^2 value is about 0.8, and again the Null hypothesis cannot be rejected. There is only chance association between these two types of diagnosis.

Discussion

Of these 121 cases, which were accumulated over a four-year period and on which complete data from all three departments were available, it is interesting to note that 26 per cent were cysts. Also, in the article by Priebe and associates⁶ an even higher percentage (approximately 55 per cent) of cysts is reported.

Various investigators have reported 90 to 95 per cent success using conservative root canal therapy. Assuming that these two sets of figures are accurate, it must be concluded that a certain percentage of cysts are successfully treated by the conservative method. This is contrary to the accepted concept of the clinical approach to epithelial-lined cysts and may suggest a new field of investigation and study.

Conclusion

Results of this study indicate:

1. Clinical and roentgenologic observations are of doubtful value in distinguishing cysts from noncystic lesions in periapical disease.

2. A re-evaluation of the roentgenologic interpretation of periapical radiolucent areas and the clinical approach to periapical lesions must be made.

3. The differential diagnosis between cysts and noncystic lesions in periapical disease can be made with certainty only by means of microscopic study of histopathologic sections.

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