Isolation of *Eikenella corroden*s in a General Hospital

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*Eikenella corroden*s is a small pleomorphic gram-negative bacillus which produces pitting on agar. From December 19, 1970, to December 2, 1971, *E. corroden*s (also known as HBI) was isolated from material submitted to the Diagnostic Bacteriology Laboratory of the Boston City Hospital from 72 patients (48 males, 24 females) ranging in age from 8 months to 92 years. The organism was recovered from sputum or bronchial washings in 46 instances, from throat or nasopharyngeal swabs in 11, from wounds in 8, from 2 human bites, and from 3 abscesses. It was isolated in pure culture from one of the human bites. Antibiotic susceptibility was measured for 26 strains against six antibiotics by using the inocula replicating method on heart infusion blood agar. *E. corroden*s was most susceptible to penicillin and ampicillin with 100% and 96% of strains inhibited by 1.65 \( \mu g \) of these antibiotics per ml, respectively. Eighty percent of the strains were inhibited by 3.125 \( \mu g \) of chloramphenicol per ml and 52% were inhibited by this amount of gentamicin. Resistance was greater for tetracycline and clindamycin.

*Eikenella corroden*s is a slender, gram-negative bacillus which characteristically produces pitting when grown on agar media (5). This organism is also known as HB1 in the classification of fastidious gram-negative rods of the Center for Disease Control (8, 13) and was originally named *Bacteroides corroden*s by Eiken in 1958 (1). He described this organism which was isolated from cultures of bronchial secretions, pleural fluid, dental granulomas, and abscesses as a "corroding bacillus" which grew only anaerobically. Ten years earlier, Henrikson (2) and Holm (4) had described an anaerobic "corroding bacillus" which resembled *Hemophilus influencae* in colonial morphology. More recently, however, Henrikson isolated 26 strains of the corroding bacillus aerobically on blood agar and suggested it was improperly classified as a *Bacteroides* (3). Jackson and Goodman (5) have proposed the name *Eikenella corroden*s in the family *Brucellaceae*.

The present report summarizes the experience with this organism in the Diagnostic Bacteriology Laboratory of the Boston City Hospital over a 1-year period.

**MATERIALS AND METHODS**

From December 19, 1970, to December 2, 1971, *E. corroden*s was isolated from 72 clinical specimens submitted to the Diagnostic Laboratory. All isolates were made from inspection of aerobic growth of small, colorless, translucent, smooth, or rough colonies on sheep blood-beef-heart infusion agar made directly from fresh frozen beef hearts. Antibiotic susceptibility testing of 26 strains was performed for six antibiotics (penicillin, ampicillin, chloramphenicol, gentamicin, tetracycline, and clindamycin) by using the replica plating method (12) on blood-brain heart infusion agar (Difco Laboratories). Plates were incubated for 48 h after inoculation with undiluted stock cultures as well as a 10\(^{-4}\) dilution of 48-h Trypticase soy broth (Difco Laboratories) cultures. Other standard bacteriological tests referred to below were performed as described by King (8).

**Organism.** The typical colony is small, colorless, translucent, and varies from a smooth to a rough form. Both smooth and rough colonies may be seen on the same plate, but it is only the rough colony that erodes into the agar.

The biochemical and physiological behavior of *E. corroden*s is summarized in Table 1. Growth is maximal at 48 h. The organism grows well on blood agar and poorly on plain beef heart infusion agar. However, growth on the latter media at 48 h is sufficient to perform the catalase test. Growth on plain agar is enhanced around disks containing hemin, but the organism does not require reduced nicotinamide adenine dinucleotide. Sugars are not fermented. There is very slight growth at 7 days on slants containing 10% glucose and 10% lactose, but there is no important change in the pH of these
TABLE 1. Biochemical and physiologic behavior of Eikenella corrodens

| Determination   | Growth | Determination   | Growth |
|-----------------|--------|-----------------|--------|
| Glucose         | -      | Indol           | -      |
| Xylose          | -      | Nitrate         | +      |
| Mannitol        | -      | Catalase        | -      |
| Lactose         | -      | Oxidase         | +      |
| Sucrose         | -      | Urea            | -      |
| Galactose       | -      | Citrate         | -      |
| Levulose        | -      | Cetrimide       | -      |
| Maltose         | -      | O-F             | -      |
| 10% Glucose     | -      | Gelatin         | -      |
| 10% Lactose     | ±      | Hemolysis       | -      |
| Lysine decarbo- | + b    | Ornithine de-   | + b    |
| boxylase        |        | carboxylase     |        |
| Arginine dihyd- | - b    | drolase         | - b    |

* - No growth; +, growth; ± slight growth at 7 days, but no reaction.
+ b 14 of 14 strains tested.

media. E. corrodens reduces nitrates. Catalase is not produced. The oxidase test is positive. The organism produces lysine and ornithine decarboxylases but not arginine dihydrolase. Incubation in a candle jar does not significantly enhance growth.

RESULTS

E. corrodens was isolated from cultures from 72 patients during the 12 months studied. During this time, approximately 140,000 specimens were processed by the laboratory. Forty-eight of the patients from whom E. corrodens was isolated were men and 24 were women. They ranged in age from 8 months to 92 years. Sixty-five of the patients were hospitalized and seven were ambulatory. About half of the hospitalized patients were on medical services and of the remaining patients, two-thirds were on surgical and one-third on pediatric services. Almost 75% of the patients were receiving antibiotics at the time E. corrodens was isolated.

As shown in Figure 1, there was no significant seasonal pattern for the isolation of E. corrodens. It was isolated from hospitalized patients from the 1st to the 30th day of hospitalization (median, 4th hospital day).

The sources of the clinical specimens from which E. corrodens was isolated are summarized in Table 2. Most of the isolations were made from cultures of the respiratory tract, but the organism was also recovered from 11 wounds and abscesses (including three which followed oral or laryngeal surgery), two human bites, an aspirate of the middle ear, and a culture of a tooth socket. E. corrodens was isolated in pure culture from only one of the 72 patients. He had an infected human bite.

Over half of the hospitalized patients had the diagnosis of pneumonia made on admission or during hospitalization. Other patients carried a variety of diagnoses including pharyngitis, gastroenteritis, gastrointestinal bleeding, pulmonary embolism, and urinary tract infection.

The results of the antibiotic sensitivity tests are summarized in Fig. 2. Twenty-six representative strains were tested. Penicillin and ampicillin were most active against these strains. Most strains were sensitive to 3 μg or less of penicillin, ampicillin, chloramphenicol, or gentamicin per ml. The organisms showed considerably more resistance to tetracycline and clindamycin. The inoculum effect was small.

DISCUSSION

The role of E. corrodens in the pathogenesis of disease cannot be determined from this study;

TABLE 2. Source of clinical specimens yielding Eikenella corrodens

| Source                                | No. of patients |
|---------------------------------------|-----------------|
| Sputum or bronchial washings           | 46              |
| Throat or nasopharyngeal cultures      | 11              |
| Wound                                 | 8               |
| Abscess or pus                         | 3               |
| Human bite                            | 2               |
| Aspirate of middle ear                 | 1               |
| Tooth socket                           | 1               |

Fig. 1. Seasonal distribution of 72 isolates of E. corrodens from various sites.
the organism was isolated in pure culture from only one patient. There have been other reports of the isolation of this organism in pure cultures from patients with otitis, sinusitis, liver abscesses, empyema, subdural empyema, osteomyelitis, and cervical abscesses (6, 9). It has been isolated in association with other organisms in a variety of abscesses and wounds (1, 3, 6, 9, 10). *E. corrodens* has been cultured from infected tonsils and probably is a normal inhabitant of the mouth (3, 11). Khairat (7) isolated *E. corrodens* 1 min after dental extraction from the blood of 16 of 100 patients studied. The organism was isolated in pure culture from three of these patients.

The classification of this organism has recently been challenged by several authors. Most recently, Jackson et al. (5) utilized deoxyribo-
nucleic acid base composition and immunological analyses to suggest that facultative anaerobic strains differ from strictly anaerobic strains in their guanine-cytosine composition and their antigenic determinants. In addition, as opposed to the strains which grew aerobically, some of their strictly anaerobic strains produced urease, hydrolyzed casein, and liquefied gelatin and had multiple polar processes when examined by electron microscopy. All of the strains reported in this series grew aerobically. Most recently, Jackson and Goodman (5) proposed that a new genus, *Eikenella*, be named to describe the facultatively anaerobic gram-negative bacillus. The genus is added to the family *Brucellaceae*.

The frequency with which *E. corrodens* was isolated in our general hospital bacteriology laboratory suggests that other hospital bacteriologists should become familiar with this organism and that attempts should be made to define further its role in infection.

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LITERATURE CITED

1. Eiken, M. 1958. Studies on an anaerobic, rod-shaped, gram-negative microorganism: *Bacteroides corrodens* N. sp. Acta Pathol. Microbiol. Scand. 43:404-416.
2. Henriksen, S. D. 1948. Studies in gram-negative anaerobes. II. Gram-negative anaerobic rods with spreading colonies. Acta Pathol. Microbiol. Scand. 25:368-375.
3. Henriksen, S. D. 1969. Corroding bacteria from the respiratory tract: 2. *Bacteroides corrodens*. Acta Pathol. Microbiol. Scand. 78:91-96.
4. Holm, P. 1950. Studies on the etiology of human actinomycosis. I. The "other microbes" and their importance. Acta Pathol. Microbiol. Scand. 27:736-751.
5. Jackson, F. L., and Y. E. Goodman. 1972. Transfer of the facultatively anaerobic organism *Bacteroides corrodens* Eiken to a new genus. Eikenella. Int. J. Syst. Bacteriol. 22:73-77.
6. Jackson, F. L., Y. E. Goodman, F. R. Bel, P. C. Wong, and R. L. S. Whitehouse. 1971. Taxonomic status of facultative and strictly anaerobic "corroding bacilli" that have been classified as *Bacteroides corrodens*. J. Med. Microbiol. 4:151-184.
7. Khairat, O. 1967. *Bacteroides corrodens* isolated from bacteremias. J. Pathol. Bacteriol. 94:29-40.
8. King, E. O. 1967. The identification of unusual pathogenic gram-negative bacteria. U.S. Dept. Health, Education and Welfare, NCOC, Atlanta.
9. Marsden, H. B., and W. A. Hyde. 1971. Isolation of *Bacteroides corrodens* from infections in children. J. Clin. Pathol. 24:117-119.
10. Reinhold, L. 1966. Untersuchungen an *Bacteroides corrodens* (Eiken, 1958). Zentralbl. Bakteriol. Parasitenk. Infektionskr. Hyg. Abt. 2 201:49-57.
11. Schröter, G., and J. Stawru. 1970. Die bedeutung von *Bacteroides corrodens* Eiken, 1958, in Rahmen der Tonsillenflora. Z. Med. Mikrobiol. u. Immunol. 155:241-247.
12. Steers, E., E. L. Folz, and B. S. Graves. 1959. Inocula replicating apparatus for routine testing of bacterial susceptibility of antibiotics. Antibiot. Chemother. Washington, D.C. 9:307-311.
Modifications of the Growth Inhibition Test and its Application to Human T-Mycoplasmas

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Volume 25, no. 4, p. 531, Table 9: Reverse column headings “Serotype no.” and “Antiserum against serotype.”

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Volume 25, no. 5, p. 708, column 2: Add reference 13 as follows:
13. Riley, P. S., H. W. Tatum, and R. E. Weaver. 1973. Identity of HB-1 of King and *Eikenella corrodens* (Eiken) Jackson and Goodman. Int. J. Syst. Bacteriol. 23:75-76.