

Beta-Lactamase-Producing Isolates of *Bacteroides* Species From Children

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Two hundred twenty-four isolates of *Bacteroides* sp. were recovered from recurrently inflamed tonsils, infected peritoneal fluid, abscesses, wounds, and burns of hospitalized children. Isolates were examined for beta-lactamase production by the chromogenic cephalosporin analog 87/312 methodology. Altogether, 119 isolates were beta-lactamase producers. Of these, 53 were in the *B. fragilis* group, 28 were in the *B. melaninogenicus* group, 12 were *B. oralis*, 4 were *B. ruminicola* subsp. *brevis*, and 22 were *Bacteroides* sp. Of 28 beta-lactamase-producing strains of *B. melaninogenicus*, 25 were recovered from tonsils. These observations indicate that in pediatric patients there is a significant incidence of beta-lactamase producers among anaerobes other than *B. fragilis*.

Although the pediatric literature suggests that anaerobic bacteria, including various *Bacteroides* spp., can cause morbidity and mortality in children, these organisms have received only limited attention. This is surprising, for species of *Bacteroides* are frequently isolated from clinical specimens (3), and significant, although variable fractions of these isolates are resistant to beta-lactam antibiotics via production of beta-lactamase.

The purposes of this study were to determine the incidence of beta-lactamase-producing *Bacteroides* sp. isolates in children and whether there is correlation between the sources of the isolates and ability to produce this enzyme.

MATERIALS AND METHODS

The *Bacteroides* spp. examined in this study were obtained during 1979 from clinical specimens processed in the Clinical Microbiological Laboratories at Children's Hospital National Medical Center. The methods of isolation and identification were those detailed in the Virginia Polytechnic Institute (5) and Wadsworth (13) manuals. The chromogenic cephalosporin analog 87/312 methodology (7) was used to determine beta-lactamase activity.

RESULTS

Of the 224 isolates, 95 were derived from core and surface specimens of surgically excised tonsils (removed because of recurrent tonsillitis), 75 were from infected peritoneal fluid, 24 were from abscesses, 20 were from wounds, 5 were from burns, and 5 were from miscellaneous sources (Table 1). Of the total, 119 (53%) produced beta-lactamase. These included 53 of 65 in the *B. fragilis* group, 28 of 73 in the *B. melaninogenicus* group, 12 of 17 *B. oralis*, 4 of 13 *B. ruminicola* subsp. *brevis*, and 22 of 61 other *Bacteroides* spp.

As shown in Table 1, peritoneal fluid was the most common source of *B. fragilis* isolates, with 41 of 46 beta-lactamase producers. The highest incidence of beta-lactamase-producing strains of *B. melaninogenicus* was found in the tonsils (46%). No beta-lactamase-producing *B. melaninogenicus* species were isolated from peritoneal fluid. Among all the strains of *B. melaninogenicus* group, strains of *B. melaninogenicus* subsp. *melaninogenicus* had the highest incidence of production of the enzyme (16 of 33 isolates).

DISCUSSION

Our finding of a high incidence of beta-lactamase-producing *B. fragilis* in infected peritoneal fluid of children is in keeping with previous observations in adults (1). This study also demonstrates the high incidence of beta-lactamase-producing anaerobes belonging to groups other than *B. fragilis* in pediatric patients. Hydrolysis of penicillins by *B. oralis* was first demonstrated by Pinkus et al. (8). Hackman and Wilkins (4) reported penicillinase activity by penicillin-resistant strains of both *B. melaninogenicus* and *B. oralis*.

A high incidence of beta-lactamase-producing strains of *B. melaninogenicus* was previously reported in adults (6). We have also observed a high incidence of these organisms, mainly among strains recovered from recurrently inflamed tonsils, abscesses, and wounds above the diaphragm. This could be due to the selective pressure of repeated penicillin administration to patients with recurrent tonsillitis. Because of its previously high success on group A beta-hemolytic streptococci (9), penicillin has been the mainstay for tonsillar infections. Beta-lactamase-producing organisms can limit the efficacy

TABLE 1. Beta-lactamase production in 224 *Bacteroides* spp. recovered from different sites in children

| Organism | Abscess above diaphragm | | Abscess below diaphragm | | Wounds and burns above diaphragm | | Wounds and burns below diaphragm | | General wounds | Peritoneal fluid | Tonsils | Miscellaneous ^b | All isolates | | | |
|---|-------------------------|----------------|-------------------------|---|----------------------------------|---|----------------------------------|---|----------------|------------------|---------|----------------------------|--------------|----|---|----|
| | + ^a | - ^a | + | - | + | - | + | - | | | | | | | | |
| <i>B. fragilis</i> group | | | | | | | | | | | | | | | | |
| <i>B. fragilis</i> | | 3 | | 1 | | | 2 | 1 | | 28 | 2 | 0 | 2 | 2 | 0 | 40 |
| <i>B. distasonis</i> | | | | | | | | | | | 2 | | | | | 3 |
| <i>B. ovatus</i> | | | | 1 | | | | | | 4 | | | | | | 5 |
| <i>B. thetaiotaomicron</i> | | | | 1 | | | 2 | | | 3 | | | | | | 6 |
| <i>B. uniformis</i> | | 1 | | 1 | | | | | 1 | 2 | | | | | | 5 |
| <i>B. vulgatus</i> | | | | | | | | | 1 | 4 | | | | | | 6 |
| <i>B. melaninogenicus</i> group | | | | | | | | | | | | | | | | |
| <i>B. melaninogenicus</i> sp. | | 2 | | 1 | | | | | 1 | | 2 | | 3 | 4 | | 13 |
| <i>B. melaninogenicus</i> subsp. <i>intermedius</i> | 1 | 2 | | | | 2 | | | | 3 | | | 8 | 11 | | 27 |
| <i>B. melaninogenicus</i> subsp. <i>melaninogenicus</i> | 1 | | | | | 3 | | | | | 14 | | 14 | 14 | 1 | 33 |
| <i>Bacteroides</i> spp. | | | | | | | | | | | | | | | | |
| <i>B. asaccharolyticus</i> | | | | | | | | | 2 | 1 | 1 | | | | | 5 |
| <i>B. ruminicola</i> subsp. <i>brevis</i> | 1 | | | | | | | | | 4 | 3 | | 5 | | | 13 |
| <i>B. ruminicola</i> subsp. <i>ruminicola</i> | | 1 | | 1 | | | | | | 1 | | | | | | 2 |
| <i>B. bivius</i> | | | | | | | | | | | 1 | | | | | 2 |
| <i>B. oralis</i> | | 1 | | | | | | | | 1 | 11 | | 4 | | | 17 |
| <i>B. corrodens</i> | | | | | | | 1 | | | | | | | | | 1 |
| <i>B. splanchnicus</i> | | | | | | | | | | 1 | | | | | | 1 |
| <i>B. ochraceus</i> | | | | | | | | | 1 | | | | | | | 1 |
| <i>Bacteroides</i> sp. | 1 | 2 | 1 | | 3 | 2 | | | 1 | 3 | 11 | 4 | 0 | 11 | 1 | 40 |

^a +, Beta-lactamase positive; -, beta-lactamase negative.

^b Miscellaneous include blood (two isolates) and eye, liver, and urine (one isolate each).

of penicillin therapy (10) by protecting the pathogenic streptococci, thus allowing the infection to continue. In a recent study of the bacteriology of recurrent tonsillitis, we have found beta-lactamase-producing organisms in 39 (74%) of our patients (I. Brook, P. Yocum, and K. Shah, Abstr. Annu. Meet. Am. Soc. Microbiol. 1980, B112, p. 35). These were isolates of *Staphylococcus aureus*, *B. fragilis* group, *B. melaninogenicus* group, *B. oralis*, and *Haemophilus influenzae*.

The isolation, in children, of beta-lactamase-producing anaerobic organisms belonging to *Bacteroides* sp. raises the question of whether the administration of penicillin for the treatment of infections adjacent to the oral cavity is always adequate. Further studies are also needed to ascertain whether therapy for these infections should also be directed at the eradication of other potential pathogens such as beta-lactamase-producing *Bacteroides* sp.

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