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Achromobacter xylosoxidans Isolates in Hawaii

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Clinical and bacteriological features of nine cases in which *Achromobacter xylosoxidans* were isolated in Hawaii are described. Five cases were ear infections mixed with other gram-negative bacteria. Colonial morphology, xylose oxidation, peritrichous flagellar staining, and antibiotic susceptibility pattern assisted in separating this bacterium from other nonfermentative, oxidase-positive, gram-negative rods.

In 1971, *Achromobacter xylosoxidans* was described and named by Yabuuchi and Ohyama, who isolated this gram-negative rod from the ear drainage of seven patients with chronic otitis media (8). In 1974, this bacterial species was further described by Yabuuchi et al. as having the following minimal biochemical characteristics: positive reactions for Simmons citrate, indophenol oxidase, and nitrate reduction; peritrichous motility; oxidation of glucose and xylose, but not maltose; and negative reactions for urease, indole production, arginine dihydrolase, and lysine decarboxylase (9). This species has been divided into two Center for Disease Control (CDC) biotypes, IIIa and IIIb: group IIIa reduces nitrate to nitrate only, whereas group IIIb reduces nitrate to gas (7).

We reviewed *A. xylosoxidans* isolates of the Straub Clinic and Hospital Bacteriology Laboratory from August 1975 to July 1977. A total of nine strains were isolated: this number was probably lower than the actual number of strains received because of initial difficulty in recognizing this bacterium. In Table 1 are listed the biochemical characteristics of our strains, tested by previously described methods (5, 7). After overnight incubation, these bacteria produced pinpoint colonies (0.5 to 1.0 mm) of circular, smooth, glossy appearance. An alkaline reaction was produced on triple sugar iron agar after 18 to 24 h of incubation. The biochemical reactions were consistent with that described previously (7, 9). Only 44% of our strains produced definite oxidation of glucose on CDC basal medium after 7 days of incubation. As mentioned by Holmes et al., glucose oxidation by *A. xylosoxidans* is dependent on the type of medium employed (4). Fifty-six percent of our isolates reduced nitrate to gas and therefore were classified as group IIIb. Antibiotic susceptibilities of our isolates were performed by the standardized disk diffusion technique (1). Most of our tested strains were sensitive to carbenicillin, chloramphenicol, sulfonamide, and trimethoprim/sulfa (Table 2). These sensitivity results are in agreement with Holmes et al., who performed antibiotic-impregnated paper strip susceptibility testing on 14 strains of *A. xylosoxidans* (4).

All of the patients in our study had clinical and bacterial recovery from their infections. The pathogenic role of *A. xylosoxidans* in our cases was difficult to determine, since these isolates were usually mixed with other gram-negative bacteria. These infections responded to broad-spectrum antibiotic therapy and local irrigation.

The majority of our isolates were from ear discharge in patients with otitis externa (Table 3). Of 35 *A. xylosoxidans* strains described by Yabuuchi et al. from Japanese sources, 16 were from ear discharge (9). This was in contrast to the isolates received by the Special Bacteriology Laboratory of the CDC (7), most of which were from spinal fluid, blood, bronchial washings, urine, and wounds. Recently, Holmes et al. described 11 clinical isolates of *A. xylosoxidans* received at the National Collection of Type Cultures, London, from 1972 to 1976. Their strains were primarily from blood, wound, or environmental samples; none were from the ear. These authors speculate that the natural habitat of *A. xylosoxidans* may be in aqueous environments, since two of their isolates were from water sources (4).

The association of *A. xylosoxidans* with otitis externa in our Hawaiian study is particularly interesting. Bacterial flora of the normal ear canal consists of only 0 to 1% gram-negative rods; however, in acute otitis externa, "*Pseudomonas* sp." is isolated in 12 to 81% of cases (2, 6). Hoadley found the incidence of *Pseudomonas* sp. to be 77.6% in otitis externa associated with swimmers, but only 33.3% in nonswimmers

TABLE 1. *Reactions of A. xylosoxidans isolates*

Test	No. of strains with positive reaction/no. of strains tested
Oxidase	9/9
Catalase	5/5
Growth on MacConkey agar	8/8
Growth on Pseudosel agar	9/9
Christensen urea	0/9
Indole	0/9
Simmons citrate	9/9
Motality	9/9
Peritrichous flagella	9/9
Gelatin liquefaction	0/9
Esculin hydrolysis	0/8
Nitrate reduction	
Nitrate to nitrite only	4/9
Nitrate to gas	5/9
Carbohydrate oxidation (CDC basal medium for 7 days)	4/9
Glucose	4/9
Xylose	9/9
Maltose	0/9
Lactose	0/9
Mannitol	0/9
Sucrose	0/9
Lysine decarboxylase (Moeller)	0/9
Arginine dehydrolase (Moeller)	0/9
Ornithine decarboxylase (Moeller)	0/9
Growth at 42°C	8/9
Growth in 0% NaCl	9/9
Growth in 6% NaCl	8/9

(3). Before 1975, *A. xylosoxidans* was considered in our laboratory as a "*Pseudomonas* sp. (non-*P. aeruginosa*)." However, *A. xylosoxidans* can be differentiated by colonial morphology, flagellar staining, and the characteristic sensitivity pattern of the species. Further studies are needed to determine the clinical role of *A. xylosoxidans* as a pathogen in otitis externa and other infections.

The assistance of Susan Naka and other members of the Straub Clinic Bacteriology Laboratory is greatly appreciated.

TABLE 2. *Disk susceptibilities of A. xylosoxidans strains*

Antibiotic	No. of strains tested	% Sensitive (% intermediate)
Ampicillin	7	14 (28
Carbenicillin	7	100
Cephalothin	7	0 (25)
Chloramphenicol	7	72 (14)
Clindamycin	4	0
Erythromycin	4	0
Gentamicin	7	0
Kanamycin	7	0 (28)
Methicillin	4	0
Penicillin	4	0
Sulfonamide	5	100
Tetracycline	7	28
Tobramycin	6	14
Trimethoprim/sulfa	7	100

TABLE 3. *Clinical characteristics of patients with A. xylosoxidans isolates*

Case	Age (yrs)/sex	Source	Associated organisms	Treatment
1	27/F	Otitis externa drainage	*Corynebacterium* sp., *Monosporium apiospermum*	Ampicillin, polymyxin B-neomycin-hydrocortisone otic drops, decongestants
2	22/M	Otitis externa drainage	*Proteus mirabilis, Enterobacter aerogenes*	Polymyxin B-neomycin-hydrocortisone otic drops, decongestants
3	23/F	Otitis externa drainage	*Staphylococcus epidermidis, P. mirabilis*	Colistin otic drops, decongestants
4	81/M	Tracheal, aspiration pneumonia	*P. aeruginosa*	Minocycline, gentamicin
5	26/M	Surgical wound	*P. aeruginosa, Acinetobacter anitratus*	Minocycline, gentamicin
6	25/F	*Herpes zoster* vesicle	*Enterobacter cloacae*	Cephalexin
7	43/M	Surgical wound (post-antibiotic treatment)	*Candida* sp.	Gentamicin, carbenicillin (for previous *Proteus morgani* and *Klebsiella pneumoniae*)
8	1/M	Otitis externa drainage	*K. pneumoniae, Escherichia coli*	Cephadrine
9	20/F	Otitis externa drainage	*S. aureus, S. epidermidis, Corynebacterium* sp.	Ampicillin, tetracycline

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