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Epidemiological studies of *Aeromonas*-related diarrheal diseases

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Key words. Epidemiology; *Aeromonas*-related diarrheas.

Published studies of the epidemiology of *Aeromonas*-associated diarrheas are relatively few. Some are based on studying matched cases and controls from hospital or clinic populations, and others on prospectively monitored groups, such as U.S. Peace Corps volunteers, entering a highly endemic area of diarrheal diseases. No data are yet published from prospective community-based studies.

Perhaps the major reasons for this relative lack of information are 1) a relatively low isolation rate when standard enteric media are used, and 2) lack of clear evidence that the organism is an enteropathogen. Most comprehensive studies of community or hospital diarrheal diseases fail to even include the organism in the list of etiologies.

By using special enrichment and selective media, however, *Aeromonas* isolation rates from stool can be improved dramatically[1,5], and in our studies in Peru, this organism is now one of the most frequently isolated from stool specimens.

Review of published literature

The epidemiologic data that are available appear to be conflicting. Studies from Thailand demonstrated a relatively high rate (9–30%) of *Aeromonas* stool isolation in the indigenous population presenting to a treatment facility regardless of whether or not diarrhea was present[7]. In persons newly arrived in this highly endemic area (U.S. Peace Corp volunteers), however, isolation rates were significantly higher among the volunteers when they had diarrhea (31–48%) than when they did not (9-15%) ($p < 0.001$)[2,3].

Studies from a treatment center in Perth, Western Australia demonstrated a significantly higher rate of *Aeromonas* isolation in children seen with diarrhea (10.8%) than with matched controls (0.7%), ($p < 0.05$)[1]. The isolation rates were highest in children ill with diarrhea between the ages of seven months to five years (about 14%). There was also a striking seasonality, with isolations predominantly being made in the warm summer and autumn months.

Studies from a clinic population in Italy[4] by way of contrast showed low isolation rates (about 1%) with no significant differences between diarrhea cases and matched controls.

Review of preliminary and unpublished data

Studies from the International Centre for Diarrheal Disease Research, Bangladesh[6] in which enrichment methods and selective media were used revealed a high rate of isolation among patients admitted with acute diarrhea (33%). In about one-third of these cases *Aeromonas* were the only potential pathogens isolated. The three species of *Aeromonas* were isolated with roughly equal frequency. Data are now being collected from non-diarrheal patients. Isolation rates were generally highest during the early warm season (March and April), with isolations being made throughout the year.

In Peru, we have carried out diarrhea surveillance among 400 families (circa 2000 people) of low socio-economic status, living in shanty-towns on the outskirts of Lima, with twice weekly home visitations. Diarrheal stools, as well as normal stools taken randomly throughout the year from all persons, were cultured for *Aeromonas* using selective techniques of enrichment in alkaline peptone water and streaking on ampicillin-blood agar[5]. Data from two years of observations revealed higher rates in the diarrhea samples than in the control samples. In 1984 when entire families were under surveillance, the isolation rate for *Aeromonas* was 18.2% in diarrhea samples and 14.2% in controls. The largest differences seen were in the group < 6 months of age where the rates were 16% and 9% in diarrhea and control samples, respectively. In 1985, when only children < 3 years of age were under surveillance, the isolation rates were 9% in diarrheal stools and 4.3% in normal stools. These differences in both years were significant. No clear-cut seasonal patterns were found in *Aeromonas* isolations. *Aeromonas* was also found regularly in the drinking water of this community throughout the year (personal communication, Dr R. H. Gilman).

These findings are compatible with other clinical and laboratory data suggesting that at least some strains of this ubiquitous organism are diarrhogenic. They suggest that primary exposures

may most often result in disease, such as in small children and visitors to endemic areas. Identifying the virulence properties of *Aeromonas* that are associated with diarrheal illness will lead to further refinement in clinical and epidemiological studies.

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Overview of four U.S. Navy overseas research studies on *Aeromonas*

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Key words. Acute diarrhea; *Aeromonas* spp.; *Plesiomonas shigelloides.*

The United States Navy conducts research on medically important infectious diseases at five laboratories within the United States Naval Medical Research and Development Command. One laboratory is Naval Medical Research Institute in Bethesda, Maryland, with a detachment in Peru. Naval Medical Research Unit No. 2 is in Manila, the Philippines, with a detachment in Jakarta, Indonesia. Naval Medical Research Unit No. 3 is in Cairo, United Arab Republic of Egypt. Data presented here were gathered during population surveys and investigations of acute diarrhea, and are focused on the role of *Aeromonas* spp. and *Plesiomonas shigelloides* in enteric disease.

1) Studies in Jakarta from July 1981 through March 1982 evaluated 1695 patients with diarrhea; 338 patients with enteric fever but not diarrhea served as controls. *Aeromonas hydrophila* was present in 11% of patients with diarrhea and 4% of the controls ($p < 0.001$). *A. sobria* was present in 3% with diarrhea and 0.6% of controls ($p < 0.05$). *P. shigelloides* was present in 0.4% with diarrhea and not present in controls (not statistically significant due to small number of isolates). *A. hydrophila* was the only potential pathogen isolated in 75 of the 182 individuals and was associated with *Vibrio cholerae* in 90 and other organisms in 17. *A. sobria* was the only pathogen in 25 of the 51 and was isolated with *V. cholerae* in 12 and other organisms in 14. *P. shigelloides* was isolated alone in 5 of the 7 individuals. Cultures were done directly from the fecal sample and again after overnight enrichment in alkaline peptone water (APW). Agars used were MacConkey, Hektoen Enteric, Thiosulfate-citrate-bile salts sucrose and *Salmonella-Shigella.*

Table 1. Prevalence of etiological agents of diarrhea at San Lazaro Hospital, Philippines, in 1983/1984

Organism	Percent positive 1983 Patients (n = 1021)	Controls (n = 201)	1984 Patients (n = 1884)	Controls (n = 375)
Aeromonas hydrophila	2**	0.5	1**	0.3
Plesiomonas shigelloides	1	0	0	0.3
Salmonella spp.	12	6	8	5
Shigella spp.	10	0.5	13	2
Enterotoxigenic *Escherichia coli*	8	5	2*	0.3
Vibrio cholerae	4	0	4	0.5
Non-ol *V. cholerae*	4	0	2	0.3
Other *Vibrio* spp.	2	0	0	0.3
Campylobacter spp.	4	2	1	0.3
Rotavirus	27	6	33	5

* Not tested in patients less than 20 years of age after March 1984; ** $p = 0.05$ vs controls (p calculated only for *Aeromonas* and *Plesiomonas*).

Table 2. Antimicrobial resistance of *Aeromonas* spp. and *Plesiomonas* spp. isolated in the Philippines and Peru

Organism	Percent resistant Ampicillin	Tetracycline	Chloramphenicol	SXT*	Erythromycin
Aeromonas spp.					
Philippines (n = 37)	57	22	16	24	8
Peru (n = 199)	98	16	28	16	85
Plesiomonas shigelloides					
Philippines (n = 33)	24	42	0	0	3
Peru (n = 21)	76	10	19	10	100

* SXT – Sulfamethoxazole-Trimethoprim.