

# Haemorrhagic Gangrene of Skin Caused by *Aeromonas hydrophila*

Bom Seock Ha, M.D., Young Ho Won, M.D., Inn Ki Chun M.D., Young Pio Kim, M.D.

Department of Dermatology, Chonnam National University Medical School, Kwangju, Korea

*Aeromonas hydrophila* is a motile gram negative rod which exists in soil and water. It can cause septicemia in persons with severe immune deficiency. Occasionally it is one of the etiologic agents of the gangrenous skin disease similar to the gangrene caused by *Vibrio vulnificus* septicemia.

A 42-year-old farmer had been suffering from liver cirrhosis for about 3 years. He had episodes of melena and hematemesis for 2 days prior to coming to the emergency room but had no skin lesions. On the 2nd hospital day, painful, erythematous and edematous skin lesions developed on his left arm and on the 3rd hospital day, several purpuras and hemorrhagic bullae developed on his left arm and leg. In the tissue, blood and blister fluid, numerous gram negative rods were identified by direct smear and culture. The bacterial identification studies from blood and blister fluid revealed *A. hydrophila*. (Ann Dermatol 1:98-101, 1989)

**Key Words:** *Aeromonas hydrophila*, Septicemia, Skin gangrene, *Vibrio vulnificus*

Strains of the genus *Aeromonas*, motile gram-negative rods, are isolated commonly from marine animals, soil, and food products.<sup>1,3</sup> Rarely have they been implicated in human disease, in part because of a lack of awareness of their potential human pathogenicity and a failure to use pathogenesis and appropriate diagnostic screening tests.<sup>4</sup>

Skin lesions identical to Ecthyma gangrenosum, the classic skin lesion of *Pseudomonas aeruginosa* bacteremia, have been reported<sup>5,8</sup> in septicemia due to *A. hydrophila*. *A. hydrophila* was originally called *Bacillus hydrophila*<sup>9</sup> in 1923, was renamed *Proteus hydrophila*.<sup>10</sup>

We present a case with skin lesions caused by *A. hydrophila* very similar to those caused by *Vibrio vulnificus*.

## REPORT OF A CASE

On June 14, 1986, a 42-year-old farmer visited the

emergency room because of hematemesis and melena for 2 days. A gastric lavage was done and a blood transfusion was given immediately. He smoked 1.5 packs a day for about 20 years and drank 360ml of Soju (a kind of liquor containing 30% ethanol) per day despite of a 3 year history of liver disease felt to be cirrhosis by the doctor at his local clinic. He had no definite history of skin injury and had not ingested raw seafood recently.

On the next day, painful, erythematous and edematous skin lesions developed on his left upper arm and he was referred to us for evaluation of the lesions.

On physical examination, there was generalized jaundice with icteric sclerae. Several vascular spiders and telangiectasia were noted on his neck and upper chest and there were tender, erythematous and edematous purpuric lesions and bullae on his left arm (Fig. 1). His liver could be palpated and was hard, tender and 2 finger-breadth enlarged.

The admission workup revealed the following: temperature, 36°C; pulse rate, 104/min; blood pressure, 70/40 mmHg; RBC, 2,090,000/mm<sup>3</sup>; WBC, 23,700/mm<sup>3</sup>; hemoglobin, 7.6g/dl; platelet, 72,000/mm<sup>3</sup>; blood sugar, 55.9mg/dl; granular casts were seen in the urine; BUN, 34.9mg/dl; creatine,

Received May 11, 1989

Accepted for publication July 15, 1989

**Reprint request to:** Young Pio Kim, M.D., Department of Dermatology, Chonnam University Medical School, Hack-1-Dong, Tong-Ku, Kwangju, 501-190, Korea

**Table 1.** Differentiation of *A. hydrophila* and *Vibrio* species

Organism	Flagellar Arrangement	Beta Hemolysis on blood Agar	Oxidase	Acid From 1% Lactose	Triple-sugar	Iron Agar	Indole	Decarboxylases	Arginine Dihydrolase			
					Butt	Slant	Gas	Hydrogen	Lysine	Ornithine		
<i>A. hydrophila</i>	Polar monotrichous (Motile) <sup>c</sup>	+ or - <sup>a</sup> (+)	+	+ or - (+)	! <sup>b</sup> (@) <sup>d</sup>	!	+ or - (+)	- (-)	+ (+)	- or + <sup>a</sup> # (-)	+	+
<i>Vibrio</i> species	Polar monotrichous	+ or -	+	+ or -	!	! or + <sup>e</sup>	-	-	+	+	+	-

<sup>a</sup> Occasional strain.

#delayed

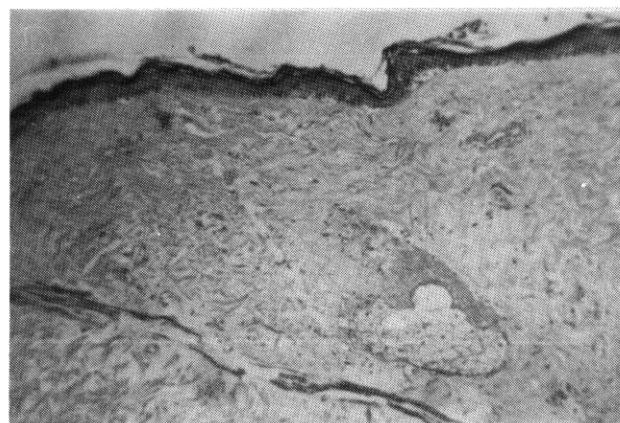
<sup>b</sup> Partly or entirely acid.<sup>c</sup> Using sorbitol indole motility agar.<sup>d</sup> Entirely acid.<sup>e</sup> Entirely alkaline.

Parenthesis means the result of the organism isolated from this case.

1.6mg/dl; Na<sup>+</sup>, 136 mEq/L; K<sup>+</sup>, 5.6 mEq/L; Cr, 104 mEq/L; Ca<sup>++</sup>, 4.2 mEq/L; AST, 90U; ALT, 38U; alkaline phosphatase, 95U; GTP, 240U; ammonia, 189µg/dl; HBsAg, negative; HBeAg, negative; antiHBs, positive; antiHBc, positive; antiHBe, positive. Liver scan showed the liver to be markedly enlarged with some evidence of fibrotic changes. As a liver biopsy was not performed, it was not possible to distinguish between his known hepatopathy and secondary hepatopathy due to sepsis.

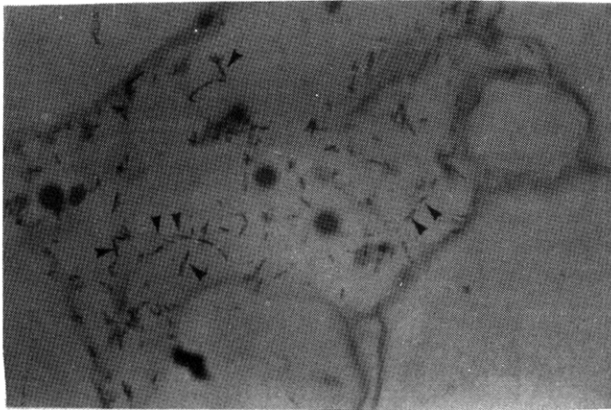
On the 2nd hospital day skin lesions extended to involve almost the entire left arm and left leg. The smear from the blood and blister fluid showed gram negative rods. Tetracycline was given in addition to ampicillin and gentamycin because of our clinical diagnosis of *Vibrio vulnificus* septicemia. On the 3rd hospital day, his mental status deteriorated as manifest by drowsiness accompanied by high fever and he was discharged from hospital hopelessly. *A. hydrophila* grew on the blood agar and enteric differential agar from blood and blister fluid the day after discharge. However, no organisms were isolated from the culture of urine, stool, cutaneous tissue and gastric lavage washings.

The biopsy specimen from the skin lesion of the left arm showed epidermal flattening, hydropic degeneration of basal layer and extravasated erythrocytes in the dermis and subcutis, but an inflammatory cell infiltration was not seen (Fig. 2). On the tissue Gram stain, numerous gram negative rods were found around the vessels in the entire dermis and subcutis (Fig. 3).

**Fig. 1.** Dark erythema with a high degree of edema, purpura and hemorrhagic bullae over the left upper arm.**Fig. 2.** The biopsy specimen from the skin lesion of the left arm showed epidermal flattening, hydropic degeneration of basal layer extravasated erythrocytes in dermis and subcutis, but an inflammatory cell infiltration was lacking (H & E stain, ×100)

### Bacterological Identification

*A. hydrophila* is a nonfastidious, gram negative, asporogenous rod shaped bacterium. The organism grows abundantly between 18°C and 38°C on

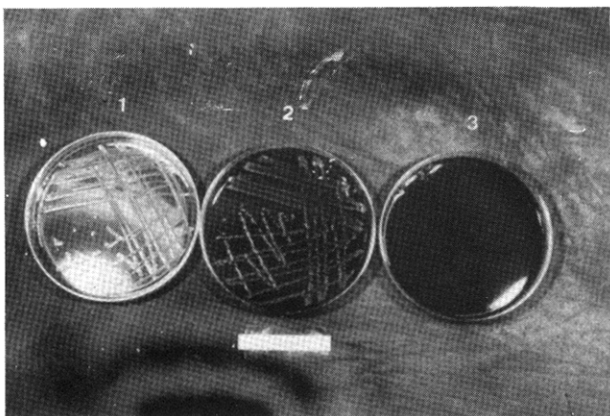


**Fig. 3.** On the tissue Gram stain, numerous gram negative rods were found (arrows) (Gram stain,  $\times 1,000$ )

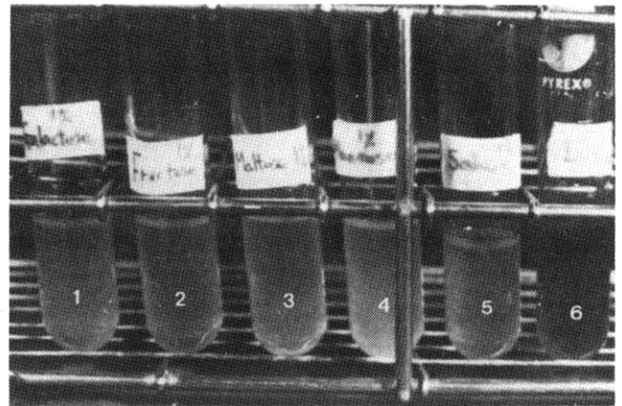
nutrient agar as well as blood agar. On blood agar some isolates are surrounded by a wide zone of completely hemolyzed erythrocytes<sup>11</sup> (Fig. 4). Of prime practical importance is the differentiation of *Aeromonas* from Enterobacteriaceae by appreciating that the former are oxidase-positive whereas the latter are oxidase-negative.<sup>12</sup> Cultures of *Aeromonas* and of *Vibrio* are differentiated in general by certain morphologic characteristics and by decarboxylase reactions.<sup>12</sup> Also *A. hydrophila* can not grow on thiosulfate-citrate-bile-sucrose agar plate (Fig. 4) and does not fermentate lactose (Fig. 5).

In many respects, *Aeromonas* sp. closely resemble members of the genus *Vibrio*.<sup>13</sup> Table 1 lists the main differential features.<sup>13</sup>

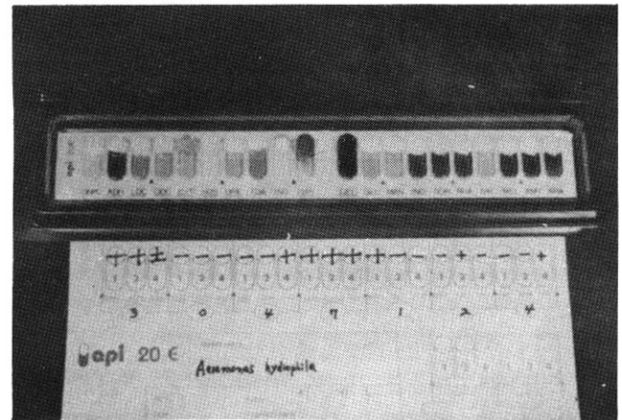
The organism found in our patient was identified as *A. hydrophila* on API 20E (Appareils et Procédés d'Identification, API System S.A., Montalieu Vercieu, France) (Fig. 6).



**Fig. 4** The organism grew on MacConkey (1) and blood agar plate (2) but not on thiosulfate-citrate-bile-sucrose agar plate (3).



**Fig. 5.** Carbohydrate fermentation test. Phenol red was used as an indicator. Galactose (1), fructose (2), maltose (3), mannose (4) and salicin (5) were positive (turn into yellow color) but not lactose (6).



**Fig. 6** The API index system according to the API Coder which simultaneously considers all biochemical results and transforms them on the seven-digit number (3-0-4-7-1-2-4) identified the organism was *Aeromonas hydrophila*.

## DISCUSSION

In increasing numbers, organisms previously thought to be saprophytic or nonpathogenic for man have been implicated as the cause of human disease. In recent years, many institutes have called attention to increasing reports of infections caused by *A. hydrophila*.<sup>9,14-16</sup>

The majority of bacteremic infections have occurred in patients with underlying neoplastic disease or chronic hepatic disease. Although *A. hydrophila* has been isolated in cases of acute gastroenteritis, it has also been recovered from stools of asymptomatic individuals.<sup>17</sup>

Most investigators have felt that *Aeromonas* is a

nonpathogen. Normally an inhabitant of non-fecally contaminated fresh water, *Aeromonas* seen to thrive in water characterized by a high content of non-fecal organic waste material, and has been recovered from city tap water, rural rivers, lakes and canals.<sup>18,19</sup>

Most septicemias with skin lesions is caused by *V. vulnificus*, *Yersinia*, *Clostridium*, *E. coli*, group A *Streptococcus*, anaerobic *Streptococcus* and *Bacteroid*. Of these, liver problems play an important role in *V. vulnificus* and *Yersinia* infection.<sup>10</sup>

The results of our sensitivity test on *A. hydrophila* agree with those of other authors.<sup>4,15,16,20</sup> *V. vulnificus* is sensitive to penicillin and cephalothin, however, *A. hydrophila* was resistant to these and sensitive to aminoglycosides such as gentamycin, chloramphenicol and tetracycline.

Three possible routes of this infection are postulated. First, it might be from the hospital water supply introduced into the gastrointestinal system during gastric lavage. With the growing importance of nosocomial, gram negative infections, there had been many reports of *Aeromonas* organisms being cultured from hospital water supplies.<sup>4</sup> However we could not culture the organism from the water used for lavage. The second possibility was from traumas. Infected wounds are the most common portal of infection in human.<sup>4,15</sup> The skin lesions of this case were over an exposed area of the left arm. Usually traumatically acquired wounds infected with *A. hydrophila* rarely progress to septicemia.<sup>15</sup> The third possibility was that the organism was an inhabitant of the hepatobiliary system. Septicemia with a fatal course could be found in patients with malignancy, leukemia and hepatobiliary system disorders.<sup>5,6,11,16,21,22</sup> He suffered from severe liver disease and had a rapidly fatal course. The last possibility was strongly suggested but it was not proven.

Because recently we have seen cases of *V. vulnificus* septicemia with severe skin lesions we initially felt that this was the cause of our patient's disease. Both *A. hydrophila* septicemia and *V. vulnificus* septicemia have a rapid course and are difficult to differentiate only by history and the clinical appearance of the cutaneous lesions. This case awakens us to a need for early and accurate microbial identification and appropriate treatment which are essential in saving lives.

## REFERENCES

1. Cowan ST, Steel KJ: *Manual for the identification of medical bacteria*. Cambridge University Press, New York, 1965, p 62.
2. Shewan JM, Hobbs G, Hodgikiss W: A determinative scheme for the identification of certain genera of gram-negative bacteria with special reference to the *Pseudomonadaceae*. *J Appl Bact* 23:379-381, 1960.
3. Miles AA, Halnan ET: A new species of microorganism causing black rot in eggs. *J Hyg Comb* 37:79-82, 1957.
4. Meeks MV: The genus *Aeromonas*: Methods for identification. *Am J Med Techn* 29:361-365, 1963.
5. Ketover BP, Young LS, Armstrong D: *Septicemia due to Aeromonas hydrophila*: Clinical and immunologic aspects. *J Inf Dis* 3:284-285, 1973.
6. Shackelford PG, Ratzan SA, Shearer WT: *Ecthyma gangrenosum* produced by *Aeromonas hydrophila*. *J Pediatr* 83:100-101, 1973.
7. Wretling B, Möllby R, Wadström T: Separation of two hemolysins from *Aeromonas hydrophila* by isoelectric focusing. *Infect Immunol* 4:503-504, 1971.
8. Ramsay AM, Rosenbaum BJ, Yarbrough CL, Hotz JA: *Aeromonas hydrophila* sepsis in a patient undergoing hemodialysis therapy. *J A M A* 239:128-129, 1978.
9. Emerson H, Norris C: Red leg: An infectious disease of frogs. *J Exper Med* 7:32-33, 1905.
10. Breed RS, Murray EGD, Smith NR: *Bergey's Manual of Determinative Bacteriology*. 7th ed, Williams & Wilkins Co, Baltimore, 1957, p 189.
11. Davis WA, Kane JG, Garagusi VF: Human *Aeromonas* infections: A review of the literature and a case report of endocarditis. *Medicine* 57:267-273, 1978.
12. Ewing WH, Hugh R: *Aeromonas* infection. In Lennette EH, Spaulding EH, Traut JP (eds): *Manual of Clinical Microbiology*. 2nd ed, American Society of Microbiology, Washington DC, 1974, pp 230-237.
13. Davis GHG, Park RW: A taxonomic study of certain bacteria currently classified as *Vibrio* species. *J Gen Microbiol* 27:101-103, 1962.
14. Abrams E, Zierdt CH, Brown JA: Observations on *Aeromonas hydrophila* septicemia in a patient with leukemia. *J Clin Pathol* 24:492-495, 1971.
15. Bulger RJ, Sherris JC: The clinical significance of *Aeromonas hydrophila*; report of two cases. *Arch Intern Med* 118:562-564, 1966.
16. Dean HM, Post RM: Fatal infection with *Aeromonas hydrophila* in a patient with acute myelogenous leukemia. *Ann Intern Med* 66:1177-1179, 1967.
17. Lantrop H: *Aeromonas hydrophila* isolated from human feces and its possible pathological significance. *Acta Pathol Microbiol Scand Suppl* 51:144-146, 299, 1961.
18. Slotnick IJ: *Aeromonas* isolates. *Ann NY Acad Sci* 174:503, 1970.
19. Geldreich EE: Microbiology of water. *J Water Pollution Control Federation* 45:1244, 1973.
20. Washington JA: *Aeromonas hydrophila* in clinical bacteriologic specimens. *Ann Intern Med* 76:611-614, 1972.
21. Gifford RRM, Lambe DW Jr, McElreath SD, Volger WR: *Septicemia due to Aeromonas hydrophila* and *Mima polymorpha* in a patient with acute myelogenous leukemia. *Am J Med Sci* 263:157-161, 1972.
22. DeFronzo RA, Murry GF, Maddrey WC: *Aeromonas hydrophila* from hepatobiliary disease. *Am J Dis* 18:323-325, 1973.