The Genus Aeromonas, Plesiomonas and Vibrio

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Channarong Rodkhum  D.V.M. (Hons), Ph.D.
Department of Veterinary Microbiology
Faculty of Veterinary Science
Chulalongkorn University
Presumptive identification of aerobic gram-negative rod (Bacilli). LF, lactose Fermentor; NLF, non-lactose fermentor
The genus Aeromonas, Plesiomonas and Vibrio

Characteristics

- Gram negative
- Facultative anaerobic rod
- Class \( \gamma \)- proteobacteria
- Ferment glucose
- Oxidase-positive
- Majority motile by flagella
- All are found in aquatic environments
- Most diseases they cause are enteric or septicemic in nature
# Key tests for phenotypic differentiation of members of the genera *Aeromonas*, *Plesiomonas*, and *Vibrio*

<table>
<thead>
<tr>
<th>Test</th>
<th>Aeromonas</th>
<th>Plesiomonas</th>
<th>Vibrio</th>
</tr>
</thead>
<tbody>
<tr>
<td>O129 susceptibility (150 µg)</td>
<td>Neg</td>
<td>Pos</td>
<td>Pos</td>
</tr>
<tr>
<td>Ornithine decarboxylase</td>
<td>(Neg)</td>
<td>Pos</td>
<td>Pos</td>
</tr>
<tr>
<td>Arginine dihydrolase</td>
<td>Pos</td>
<td>Pos</td>
<td>Neg</td>
</tr>
<tr>
<td>Inositol fermentation</td>
<td>Neg</td>
<td>Pos</td>
<td>(Neg)</td>
</tr>
<tr>
<td>Gas from glucose</td>
<td>Var</td>
<td>Neg</td>
<td>Neg</td>
</tr>
<tr>
<td>Growth in nutrient broth without NaCl</td>
<td>Pos</td>
<td>Pos</td>
<td>(Neg)</td>
</tr>
</tbody>
</table>

Neg, Negative; Pos, positive; (Pos), almost Positive; (Neg), almost negative; Var, variable
Characteristics

- Family Aeromonadaceae
- Gram Negative rod or coccoid
- Catalase-Positive, Oxidase-positive
- Reduce Nitrate to nitrite
- Resistant to Vibriostatic agent O129
- Most species possess flagella (except *Aeromonas salmonicida* isolated from fish).
- Grow at 10 – 42 °C
- Almost pathogenic for fish and shellfish.
*Aeromonas hydrophila* Gram stain

*Aeromonas hydrophila* colony morphology
Epidemiology

• Many aquatic species

• Reptile

• Amphibians

• Swine, cattle, birds and marine mammals (rare)

• Zoonosis (Food-borne disease, septicemia, peritonitis, urinary tract infections)
Pathogenicity and Pathogenesis (1)

Virulence factors

• Toxins; Shiga like toxin, hemolysins (Aerolysin) enterotoxin

• Surface proteins ; Outer membrane protein

• Surface structures ; flagella, pili

• Extracellular degradative enzymes ; protease, metalloprotease, lipase, phospholipase
Pathogenicity and Pathogenesis (2)

Pathogenesis

• Colonization and invasion into host organs

• release extracellular products

• Massive septicemia and toxic extracellular products of the organism

• Interfere with host blood supply and result in massive tissue necrosis
## Diseases and primary hosts of *Aeromonas* that are significant in Veterinary Medicine

<table>
<thead>
<tr>
<th>Genus and species</th>
<th>Hosts</th>
<th>Diseases</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Aeromonas hydrophilla</em></td>
<td>Frogs</td>
<td>Red leg disease</td>
</tr>
<tr>
<td></td>
<td>Eels</td>
<td>Fresh water eel disease</td>
</tr>
<tr>
<td></td>
<td>Reptiles</td>
<td>Necrotic stomatitis</td>
</tr>
<tr>
<td></td>
<td>Cultured warm-water fish</td>
<td>Fin/tail rot and hemorrhagic septicemia</td>
</tr>
<tr>
<td></td>
<td>Human</td>
<td>Food poisoning</td>
</tr>
<tr>
<td></td>
<td><em>Aeromonas salmonicida</em> spp.</td>
<td>Cellulitis, peritonistis</td>
</tr>
<tr>
<td></td>
<td><em>salmonicida</em></td>
<td>Furunculosis (Ulcer disease)</td>
</tr>
</tbody>
</table>
Aeromonas sp. infection in frog

Frog with lesions of “red leg”
Aeromonas hydrophila infection in rainbow trout with skin ulcer (photo courtesy of D. Bruno)

Clariid catfish (*Clarias batrachus*) with ulcerative form of haemorrhagic septicaemia caused by *Aeromonas hydrophila* (photo courtesy of Dr. Kriengsag Saitanu)
A. *hydrophila* infection (cellulitis of forearm) following puncture with fishing hook (photo courtesy of Dr. Haburchak)

Forearm showing bullous lesions as a result of *A. hydrophila* infection (photo courtesy of Dr. Haburchak)

Leg showing Ecthyma gangrenosum (photo courtesy of Medscape)
Diagnosis:

• Symptoms

• Culture and identification of bacteria

• Grow well on media such as nutrient agar, Tryptic soy agar (TSA), blood agar
The genus *Plesiomonas*

**Characteristics**

- Family *Enterobacteriaceae*
- Gram Negative rod or coccoid
- Catalase-Positive, Oxidase-positive
- Reduce Nitrate to nitrite
- Susceptible to Vibriostatic agent O129
- Most strains are motile by flagella
- Most strains are found in aquatic environments
Epidemiology

• Aquatic environments

• isolated from fresh water estuarine water, and salt water

• isolated from fresh vegetables, shellfish and intestine of healthy snakes, monkeys, mice, dogs, cats, swine, goats, raccoons, fish and ducks
Pathogenicity and Pathogenesis (1)

Virulence factors

• Enterotoxins; Cholera-like toxin, Shiga-like toxins

• Heat-stable enterotoxin

• Hemolysin
Pathogenicity and Pathogenesis (2)

Pathogenesis

- Colonization and invasion into host organs
- Release extracellular products
- Massive septicemia and toxic extracellular products of the organism
- Interfere with host blood supply and result in massive tissue necrosis
Animal diseases due to *P. shigelloides* have rarely been reported.

- Diarrhea in cats, septicemia in fish
- Zoonosis; diarrhea in human (rare)
- Immunocompromised individual appear to be more susceptible to infection
Diseases and primary hosts of *Plesiomonas* that are significant in Veterinary Medicine

<table>
<thead>
<tr>
<th>Genus and species</th>
<th>Hosts</th>
<th>Diseases</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Plesiomonas shigelloides</em></td>
<td>Cultured tilapia</td>
<td>Septicemia</td>
</tr>
<tr>
<td></td>
<td>Rainbow trout</td>
<td>Septicemia</td>
</tr>
<tr>
<td></td>
<td>Reptiles</td>
<td>Septicemia</td>
</tr>
<tr>
<td></td>
<td>Harbour seals</td>
<td>Diarrhea</td>
</tr>
<tr>
<td></td>
<td>cats</td>
<td>Diarrhea (rare)</td>
</tr>
<tr>
<td></td>
<td>Human</td>
<td>Diarrhea, neonatal meningitis, cellulitis.</td>
</tr>
<tr>
<td></td>
<td>(esp. immunocompromised)</td>
<td>Cholecystitis, osteomyelitis</td>
</tr>
</tbody>
</table>
Diagnosis:

• Symptoms

• Culture and identification of bacteria

• Selective media for *Plesiomonas shigelloides*:

  *inositol-brilliant green-bile salts agar*
The genus Vibrio

Characteristics

- Family Vibrionaceae
- Proteobacteria, $\gamma$- subdivision
- Gram-negative, curved-rod
- Facultative anaerobe, ferment glucose
- Motile by polar-flagellum
- Catalase-Positive, Oxidase-positive (except V. metschnikovii)
- Reduce Nitrate to nitrite
- Susceptible to Vibriostatic agent O129
- Growth of Vibrios is stimulated by NaCl (Halophilic bacterium)
Epidemiology

- Common in marine and estuarine environments
- Can be isolated from sediment, water, shellfish, and intestinal tract of marine mammals and fish
- Can cause diseases in mammals
General virulence factors of pathogenic Vibrio

- Capsular polysaccharide
- Extracellular Product
  - Hemolysin
  - Cytolysin
  - Protease
- Pili
- LPS
- Surface antigen
- Iron uptake system
- Flagellum
### Diseases and primary hosts of *Vibrio* that are significant in Veterinary Medicine in Thailand

<table>
<thead>
<tr>
<th>Genus and species</th>
<th>Hosts</th>
<th>Diseases</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Vibrio cholerae</em></td>
<td>Human</td>
<td>Cholera</td>
</tr>
<tr>
<td><em>V. parahaemolyticus</em></td>
<td>Human</td>
<td>Food poisoning associated with seafood</td>
</tr>
<tr>
<td><em>V. metschnicovii</em></td>
<td>Chickens</td>
<td>Severe enteric disease</td>
</tr>
<tr>
<td><em>V. anguillarum</em> (Listonella anguillarum)</td>
<td>Fish, eel, shrimp</td>
<td>Vibriosis, hemorrhagic septicemia</td>
</tr>
<tr>
<td><em>V. ordalii</em></td>
<td>fish</td>
<td>Vibriosis, hemorrhagic septicemia</td>
</tr>
<tr>
<td><em>V. alginolyticus</em></td>
<td>Shrimp</td>
<td>Vibriosis</td>
</tr>
<tr>
<td><em>V. haveyi</em></td>
<td>Shrimp, fish</td>
<td>Vibriosis</td>
</tr>
</tbody>
</table>
Vibriosis in fish cause by *V. anguillarum*

Vibriosis in *Penaeus monodon* cause by *Vibrio alginolyticus, V. parahaemolyticus and V. anguillarum*
Diagnosis:

• Symptoms

• Culture and identification of bacteria

• Selective media for *Vibrio* spp.:
  - *Thiosulfate citrate bile-salt sucrose agar (TCBS)*
  - *Growth of Vibrios is stimulated by NaCl*
Prevention and control of Vibriosis in fish with vaccination