

SHIGELLA SPP.

Dean O. Cliver

Introduction

Four species (*boydii*, *dysenteriae*, *flexneri*, *sonnei*) = serogroups
Shigellosis = **bacillary dysentery**
Host-adapted to **humans** (primates)

Characteristics of the disease

Infectious dose is 10–100 organisms
Incubation period is ½–4 (usually 1–3) days; up to a week for *S. dysenteriae* 1
Illness: diarrhea with fever and nausea; sometimes toxemia, vomiting, cramps, and tenesmus; dysentery—blood and mucus in stools; may cause hemolytic uremic syndrome; most severe in infants; mild and asymptomatic infections occur
Duration: 4–7 days; shedding up to 4 weeks; both shortened by **appropriate** antibiotics (multiple resistance common)

Characteristics of the organism

Nonmotile, nonsporeforming, gram-negative short rods; close genetic relationship to *E. coli*
Invades the colonic epithelium; many strains produce shigatoxin or shiga-like toxin
Temperature range for growth (strain-dependent) 7–46°C, optimum 37°C
pH range for growth 5–8, acetic acid stops growth at pH 6

Transmission via food

Fourth-ranked cause of foodborne disease in U.S., 1998–2002 (~735/yr), per CDC
CAST estimates 90,000–163,000 cases per year, ≤ 180 deaths, \$390 average cost/case
CDC estimates ~90,000 cases per year, 14 deaths
FoodNet (2005) — 4.7 cases/10⁵ US population ≈ 14,000 cases
Survives well in neutral pH foods, poorly in acid foods, may grow (e.g., in watermelon)
Vehicles may be anything contaminated with infectious human feces: water (2 outbreaks in U.S., 1994), baked goods, fruits and vegetables, chicken, hamburger, potato salad, and finfish have been implicated in outbreaks

Isolation and identification

Food samples held at 4°C or frozen if held >24 hr
Various enrichment broths and selective media are used—fairly typical of those for gram-negative bacteria
Usually lactose negative; many other biochemical tests apply
Species identification is largely serological
“Molecular” detection, typing and subtyping methods are available

Treatment and prevention

Treatment with antibiotics is possible, but susceptibility testing is advised because multiple resistances are common
Prevention is largely based on sanitation

Summary

Shigella is widespread and potentially deadly; shed in **human** feces
Frequent transmission via food indicates frequent sanitation failure

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YERSINIA ENTEROCOLITICA

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Introduction

Genus *Yersinia* was spun off from genus *Pasteurella*; includes *Y. pestis*, which causes plague.

Y. enterocolitica is the principal foodborne species and has a reservoir in **swine**.

Characteristics of the disease

Incubation period usually 3–7 days, generally under 10 days

Acute febrile diarrhea; enterocolitis; **may mimic acute appendicitis**; postinfectious arthritis in adolescents and young adults

Characteristics of the organism

Gram-negative, nonsporeforming rods; facultatively anaerobic; motile by peritrichous flagella (only at temperatures <35°C)

Growth range of temperatures is -2–42°C, optimum 28–29°C; in raw pork at 7°C, has grown to 10⁹–10¹⁰ cells/g within 10 days

pH range for growth is 4.2–9.0, with an optimum of 7–8

Grows in the presence of 5% but not >7% NaCl

Virulence is plasmid-dependent and is limited to a few serotypes (humans, mainly O:3)

Transmission via food

CDC reported 8 foodborne outbreaks (87 cases) of yersiniosis during 1998–2002.

CAST report estimates 3,250–20,000 cases of foodborne yersiniosis per year in the U.S., with perhaps one death; the cost per case is estimated at \$5,450.

CDC estimates ~87,000 foodborne cases/year, 2 deaths.

FoodNet (2005) — 3.6 cases/10⁶ US population ≈ 1,080 cases

Y. enterocolitica has been isolated from many foods in addition to pork, but the strains found in these other vehicles appear to be avirulent for humans.

Transmission via water and dairy products has been reported; one outbreak was traced to tofu packed in spring water.

Isolation and identification

Samples held at 4°C if possible

Cold enrichment: macerate food in phosphate-buffered saline, incubate at 4°C for 2–4 weeks (or at 10°C for 3 days, or at 15°C for 2 days?).

Enrichment culture sometimes treated with 0.5% KOH for 15 sec before plating—kills many competing organisms.

Selective media may be inhibitory with 35–37°C incubation—use temperatures ≤32°C.

PCR detection is also an option.

Treatment and prevention

Can be treated with antibiotics other than penicillin and its derivatives.

Prevention is generally based on thorough cooking of pork and on sanitation, including hand washing.

Summary

Foodborne yersiniosis is a highly specialized problem involving transmission from swine.

It should be preventable by careful handling and cooking of pork and by avoiding cross-contamination of other foods; however, *milk and dairy products have also been vehicles.*

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