Hepatitis A and Norovirus

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Agenda

• Hepatitis A
• Norovirus
• Recent Hepatitis A Outbreak
• Recent Norovirus Outbreak
NOROVIRUS

You don’t want it.
YouTube Clip

- http://www.youtube.com/watch?v=U7r3hyu58&feature=related
Norovirus

- 1st outbreak was in a school in Norwalk, Ohio in 1968
  - Gastroenteritis cases
- Caliciviridae Family
- Small round structural virus (28-38 nm)
- Single Stranded RNA Virus
Genogroups

• Five genogroups (GI-GV) based on amino acid identifiers
  – GI, GII, and GIV are in human
  – GIII and GV are in cows and mice
  – GII are in pigs and GIV in dogs
• Zoonotic transmission is the key
  – No cases of calf to human or pig to human transmission have been found
Norovirus: Statistics

• Annual: 5,500,000 cases of disease (#1), 15,000 hospitalizations (#2), and 150 deaths (#4)
• 50% of gastroenteritis outbreaks
• Winter time has more outbreaks
Norovirus: Infection

• In U.S. 67% of adults have serum antibodies
• Protective immunity is not completely understood
• Diagnosis is based on patient stool and enzyme immunoassay
Infection, cont.

• Incubation is 24 to 48 hours
• Infect and kill cells of the small intestinal mucosa
• Pass through digestive tract and shed in feces
• Symptoms last about 1-6 days
• Shedding in feces can last for up to 4 weeks
Norovirus: Symptoms

- Symptoms:
  - non-bloody diarrhea, vomiting, nausea, abdominal cramps, low grade fever
- 30% of persons are asymptomatic (without symptoms)
- Fast acting process within 10 hours after ingestion
Norovirus: Infection Rate

• Peak shedding is at 2-5 days
• Infection dose is \(~18\) viral particles (10 to 100 is range)
• \(~100\) billion viral copies per gram of feces
• \(~5\) billion infectious dose per gram of feces
Norovirus: Survival

• Surfaces up to 42 days
• On foods in a refrigerator for up to 10 days
• Freezing indefinitely
• More resistant to chlorine (5-6ppm) than other enteric viruses
• Chlorine of 0.5-1mg for 30 minutes
• 60°C for 30 minutes
• Depuration of oysters and mussels
Norovirus: Survival

• Resistant to strong acidic conditions (pH 2)
  – 3 hours at pH 2.7
• Tolerated salt concentrations ranging from 0.3% to 6.3% NaCl
• In a study Norovirus was able to survive 29 days in water, 4 days on lettuce, 12 days on soil, and 15 days on stainless steel disks
  • Lettuce at 4C and 23C for 2 weeks → reduced by 1 log
Norovirus: Death

- Hand washing
- Chlorine bleach for surfaces (5,000ppm)
- Phenolic compounds are less effective
- Heat disinfection (pasteurization to 140°F)
- Ozone and hydrogen peroxide are also effective
Norovirus: Outbreaks

• Norovirus causes acute gastroenteritis
• 1995-2006: 660 Norovirus Outbreaks
  – 234 long term facility
  – 205 restaurants, parties, and events
  – 135 vacation settings
  – 86 in schools and communities
Sources of Outbreaks: CDC, 2001-2008

- Food: 32%
- Workers: 31%
- Neither: 37%
- Either: 63%
HEPATITIS A
Hepatitis A: Family

- Picornaviridae Family
  - Same as polio, eco, and coxsackie virus
- Single stranded RNA
- Spherical with smooth surface (~28 nm)
- Positive single strand sense, naked, and icosahedral capsid
Hepatitis A

- Capsid comprised by 60 copies of 4 different structural peptides
  - protects the nucleic acid of the virus from attack by host's defensive cells
  - attaches to a specific receptor site of a cell membrane
- Coat proteins require enzymes to replicate and translation of capsid region is selectively enhanced
Hepatitis A

- Multiple types of Hepatitis A,B,C,D,E,F
  - A – only one relevant to food service
- Hepatitis means inflammation of the liver
- Liver is the site of pathogenesis
- Body responds to infection which results in a destruction of hepatocytes
Hepatitis A Pathogenesis

- Ingestion
- Replication in oropharynx/GI tract
- Transported to liver - major site of replication
- Shed in bile, transported to intestines
- Shed in feces
- Brief viremia
- Cellular immune response: clinical disease and control

Incubation Period (15-50 days)
Hepatitis A: Statistics

- About 3,600 cases of hepatitis A are reported each year
  - ~3-6 deaths per 1,000 cases
  - Globally 1.4 million cases
- Endemic in many developing countries
- Vaccine is required for children 1 to 2 years old in the U.S.
- Outbreaks are rare because young children are typically asymptomatic
Sources

• Human GI Tract
• Polluted Water
• Raw Shellfish
• Raw fish/crustaceans
• Deli meat
• Produce
Hepatitis A: Vaccine Recommendations

- Travelers to areas with higher rates of Hepatitis A
- Drug users (both injecting and non-injecting)
- Those with blood clotting disorders
- Those with chronic liver disease
- Those who risk infection in the workplace
- Members of households with an adopted child arriving from a country with a high rate of Hepatitis A
Hepatitis A: Infection

- Fecal-Oral transmission
- Incubation period is 15 to 50 days (medium 28 to 30 days)
- Shed in feces 10 to 14 days before onset of illness and 7 to 14 days after onset of illness
- The infectious dose is unknown but presumably is 10-100 virus particles
Hepatitis A: Symptoms

- Symptoms: Dark urine, jaundice, fever, loss of appetite, anorexia, vomiting and malaise
- Lifetime immunity after first attack
- 10% of HAV transferred from contaminated fingers to food and surfaces
Hepatitis A: Survival

- Heat and Drying Resistant
- pH as low as 2 for a short period
- pH of 1 at 5 hours still alive: Fruit juice
- Tap water at 20°C for 40 days and 4°C for 60 days
- Dry surface at 20°C for 50 days and 4°C for 60 days
Hepatitis A: Death

- Boiling at 100°C: liquid and solid foods
- Pasteurization: liquids and soils
- Drying: dried milk, dessert mixes, soups
- Freezing: ice cream
- Chlorination for 1 minute at 50ppm
- Ethanol 70% for 10 minutes
Hepatitis A: Prevention

- Good Personal Hygiene
- Exclude all infected workers
- NO raw shellfish
- Purchase from reputable suppliers
- Steam shellfish for 90 sec (184-194° F/ 4min)
OUTBREAKS WITH NOROVIRUS AND HEPATITIS A
Norovirus Outbreaks

• Two Frozen Raspberries
• Re-useable Bags
• Others
Outbreak 1: Imported frozen raspberries

- March and August of 2009
- Imported frozen raspberries from Finland
- 900 people ill from raspberries
- In several primary schools
- Good hygienic conditions
- 2 of 9 workers fell ill prior to the infection days of illness
Cause of Frozen Raspberry

- Freezing is no an effective decontamination method
- Wholesaler was able to trace the raspberry back to a potential 62 different farms (TRACEABILITY?)
- Therefore, conclusions could not be made
- Assumption of irrigations water, worker hygiene, sewage as a fertilizer, no good agricultural practices or handling practices
Outbreak 2: Norovirus and Frozen Raspberries

- Denmark with imported raspberries from Poland
- 5 outbreaks between June and September of 2005
- All occurred in institutions or commercial catering
- 1000 people affected by the outbreaks from one large batch of raspberries
Cause of Frozen Raspberry Outbreak

• Linked to several different small-scale farms in Poland
• Purchased during summer 2004 by a Polish company and frozen into 2.5kg plastic bags
• At farm level:
  – Fecal contamination in irrigation water
  – Harvested by infected farm workers and/or during processing and freezing by infected workers at company level
Outbreak 3: Reuseable Bags

• October of 2010 in Oregon
• Norovirus outbreak was linked to reusable grocery bags
• Soccer player became very ill after chaperones placed cookies into a reusable grocery bag
• Bag was positive 2 weeks after the incident occurred
Other Outbreak

• Shucked oyster meat from Korea was recalled from Washington after 3 people are sick in November of 2011
Hepatitis Outbreaks

• Green Onions
• Frozen Strawberries
• Clams
Outbreak 1: Hepatitis A Outbreak with Green Onions

- November 2003 in Pennsylvania restaurant
- 601 patients identified: 3 died, 124 hospitalized
- Green onions served in mild salsa dip
Investigation of Salsa

• Tap water-municipal water
• Green onions
• Canned tomatoes and Canned green chiles
• Spice mix-Bulk regional distributor
• Diced white onions-washed with chlorinated water and machine diced before shipment
Cause of Outbreak of Green Onions

• Green Onions
  – Packed on ice and shipped in 6 to 8 bundles
  – Placed in refrigerator for up to 5 days
  – Chopped as needed and rinsed with tap water
  – Dicer was solely for green onions

• Two Mexican farms identified

• No repacking occurs between packing shed and delivery vehicle
Causes of Green Onion, continues

• Outbreaks with Hepatitis A in 1999, 2000, and 2003 with same sequence cluster
• Passes through 2 or more distributors in the U.S.
• Linked to either
  – Irrigation water contamination
  – Packing house water contamination
  – Contaminated personnel
Outbreak 2: Multistate Frozen Strawberries

- February and March 1997
- RNA detection of clinical specimens
- 213 cases from 23 schools in Michigan
- 29 cases from 13 schools in Maine
- 2 cases in Tennessee, 9 cases in Arizona and 5 cases in Wisconsin
- 4 cases in Louisiana in smoothies made from strawberries
Cause of Outbreak of frozen strawberries

- Strawberries were grown in Mexico and processed and frozen in California plant into 30 lb containers
- No illness at among employees reported
- Strawberries were carried on a conveyor belt that was sanitized with only 12ppm of chlorine
- Mechanically sliced and packed with sucrose
  Hand contact was limited to unacceptable berries
Cause, continues

• 3 of 4 growing fields were investigated
  – Water for drip irrigation was piped from river and filtered by sand tanks
  – Limited hand washing facilities
  – Pickers did not wear gloves and removed stems with fingernails
Outbreak 3: China and contaminated clams

- Shanghai, China in 1988, 300,000 people got ill after consuming contaminated clams
- 47 deaths occurred
- ~90% of persons ate uncooked clams
- Cause blamed on heavily polluted coastal waters
- Largest outbreak in history
Hepatitis A and Norovirus Outbreak in Clams

• Imported from China
• Labeled cooked but appeared raw
• 5 cases of Norovirus in New York in August 2000
• Calms had high fecal coliform counts
Summary of Today’s Webinar

• Hepatitis A
• Norovirus
• Recent Hepatitis A Outbreak Explanation
• Recent Norovirus Outbreak Explanation
Additional Questions

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