Pathogenic *E. Coli*

•Hundreds of strains of *Escherichia coli.*
• Most harmless, living in intestines of healthy humans and animals.
•*E.coli* strains have somatic (O) and flagellar (H) antigens
•Has specific virulence characteristics that usually are plasmid-mediated.

•**Enterohemorrhagic *E.coli* (EHEC)** strains: Hemorrhagic colitis
-*E.coli* O157H7, less frequently other serotypes of *E.coli* (O26:H11)
-Cytotoxins resembling *Shigella dysenteriae, toxin* type 1 = shigalike toxins or verotoxins.
-Diarrhea: Bloody or non- bloody diarrhea
-Complication: Hemorrhagic colitis and hemolytic uremic syndrome in all ages and thrombotic thrombocytopenic purpura in adults

•**Enteroinvasive *E.coli* (EIEC)** strains
-Serorypes O28, O112, O115, O124, O136, O143, O144, O147, O152, O164, O167)
-EIEC strains resemble Shigella biochemically and can invade intestinal epithelial cells.
-Diarrhea with fever in all ages, watery or blood

•**Enteropathogenic *E.coli* (EPEC):**
-O serogroups: O44, O55, O86, O111, O114, O119, O125, O126, O127, O128, O142, O158.
-Adhere to intestinal mucosa ➔ characteristic lesion in the gastrointestinal tract. Do not produce enterotoxins , not invasive.
-Acute and chronic endemic (sporadic) and epidemic diarrhea in infants
-Causes of infantile diarrhea, watery 90%, severe ➔dehydration, fever 60%

•**Enterotoxigenic *E.coli* (ETEC):**
-O6:H16, O8:H9 or O8:H-, O15:H11or other H-
-Adhere and produce either or both heat-labile and/or heat-stable enterotoxins.
-Colonize small intestine without invading
-Infantile diarrhea in developing countries and travelers' diarrhea (40%), watery; low fever if any

•**Enteroaggregative *E.coli* (EAggEC)**
-Characteristic adherence pattern in tissue-culture-based assays: "stacked brick" adherence pattern on HEP-2 or HeLa cells.
-Chronic diarrhea in infants, watery

• **Shiga Toxin producing *E.coli* (STEC)**
-Used for all Entero-hemorrhagic *E.coli* without having to determine their O and H types.
-Most STEC infections in U.S .caused by *E. coli* O157:H7.
-Non-O157 STEC bacteria =150 STEC serotypes ; In U.S. 6 non-O157 serogroups (O26, O45, O103, O111, O121 and O145)
-Diagnosed by
-Enzyme immunoassay (EIA), polymerase chain reaction (PCR) to detect Shiga toxin or genes encoding toxins (stx1 and stx2)
-Pure culture needed for serotyping and molecular characterization (PFGE patterns), essential for detecting, investigating and controlling outbreaks.

•**EHEC hemorrhagic colitis**: treatment does not prevent progression to HUS
•**EPEC**
-mild diarrhea: non-absorbable antibiotics (neomycin, gentamicin, orally, tid for 5 days), not if inflammatory or bloody diarrhea because of potential toxicity if absorbed
-moderate to severe: trimethoprim-sulfamethoxazole
-systemic infection suspected: parenteral antimicrobials
•**EIEC** Dysentery: trimethoprim-sulfamethoxazole
•**EPEC** chronic diarrhea: trimethoprim-sulfamethoxazole, orally
•**ETEC**:
-drink only carbonated beverages and boiled or bottled water
-avoid ice, salads, and fruit they have not peeled themselves
-eat only hot food
-antimicrobial agents usually are not recommended for prevention of travelers' diarrhea
-If treatment necessary: antimicrobial agents
trimethoprim-sulfamethoxazole,
doxycycline,
ciprofloxacin,
effective prophylactically
benefit usually is outweighed by the potential risks

E. Coli O157:H7

Epidemiology

Source:
-Normal flora in animal intestinal tract,
-Cattle, deer, sheep, dogs, horses, flies, birds.
-Contaminated food (beef, dairy products, produce, water
Anatomical source: Stools
Transmission
- Ingestion of contaminated food/water
- Contact w/ animals & their environment
- Person-to-person
- Fomite spread

Infectious dose
Low- 100 organisms

Incubation
3-4 days
(1-8 days)

Clinical case definition
- Diarrhea (often bloody)
- Hemorrhagic colitis
- Hemolytic uremic syndrome (HUS)
- post-diarrheal thrombotic thrombocytopenic purpura (TPP)
- Severe abdominal pain
- fever

Complication:
- HUS in children- microangiopathic hemolytic anemia, thrombocytopenia, acute renal dysfunction
- Diabetes mellitus
- TPP in adults

Death: 3%-5% fatality rate for HUS

~265,000 STEC cases per year in the U.S. 36% are O157:H7.

Outbreaks
- Food sources (ground beef, fruits, raw produce)
- Petting zoos
- Recreational water areas

Diagnosis

Shiga-toxin producing *Escherichia coli* (STEC). O157:H7 is the most common strain

Lab Diagnosis
- **Isolation of *E. coli* O157:H7 from a specimen**
- Transport on Cary-Blair transport media
- Isolates can be identified presumptively by lack of sorbitol fermentation on MacConkey-sorbitol agar culture plates
- Isolation of Shiga toxin-producing *E. coli* O157 from a clinical specimen
- **Use antisera to serotype *E. coli***
- Test any patient with HUS for *E. Coli* . Negative does not rule out diagnosis

Suspect: Post diarrheal HUS or TTP
Probable:
•Isolation of *E. coli* O157 from a clinical specimen
•A clinically compatible case that is epidemiologically linked to a confirmed case
•Identification of Shiga toxin in a specimen from a clinically compatible case
Confirmed:
Clinically compatible case with
•Isolation of *E. coli* O157:H7 from a specimen,
•Isolation of Shiga toxin-producing *E. coli* from a clinical specimen

Treatment, Prophylaxis

Treatment
- Prevent or correct dehydration and electrolyte imbalance
- Antimicrobial therapy has not been proven beneficial and may increase the risk of HUS

Contact precautions

Control

Food
•All ground beef should be cooked thoroughly until no pink remains and juices are clear
•Milk, milk products, and fruit juices should be pasteurized
•Thorough hand washing with soap, especially after using the bathroom or contact with animals

Notify public health authority of outbreaks in childcare centers

Exclude children from childcare centers , food handlers, and healthcare workers until illness is resolved, and one negative culture is obtained.

People with diarrhea should avoid recreational water areas for 2 weeks after illness