Hemolytic Uremic Syndrome, post-diarrheal (HUS)
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Case Definition - **Hemolytic Uremic Syndrome (HUS) – 1996 Case Definition**

Overview

- ***Agent*** – Hemolytic Uremic Syndrome, post-diarrheal (HUS) is a medical condition characterized by anemia caused by the destruction of red blood cells and impaired kidney function. The most common cause of HUS is an infection with Shiga toxin-producing *E. coli* (STEC), particularly the *E. coli* O157:H7 strain. However, there are rare cases where viral or bacterial infections such as *Salmonella*, *Campylobacter*, *Streptococcus pneumonia*, *Shigella* and some medications can also lead to HUS.
- ***Reservoir*** – HUS is a serious sequela of enteric infection with STEC. In North America, 70% of HUS cases had prior infection with STEC in the weeks before onset. *E. coli* 0157 is responsible for most of these STEC cases (95%) and is mainly found in healthy ruminant animals such as cattle, sheep, and deer.
- ***Environment*** – See the appropriate pathogen-specific section in this manual for more information.
- ***Occurrence*** – See the appropriate pathogen-specific section in this manual for more information.
- ***Risk Factors –*** Anyone can get HUS, but children under five, individuals with weakened immune systems, and individuals with family history of HUS are at higher risk. 15% of children with *E. coli* O157 infection go on to develop HUS, versus 6% of adults. Older adults are at higher risk of death due to HUS.
- ***Mode of Transmission*** - HUS, as a clinical syndrome, cannot be transmitted. However, bacteria such as *E.coli* O157:H7, responsible for causing most HUS, can be transmitted through various means such as food, water, animals, environment, and person-to-person contact. See the appropriate pathogen-specific section in this manual for more information.
- ***Period of Communicability*** – People with HUS are only contagious if they have the bacteria causing the clinical syndrome (such as STEC or *Shigella*) in their stool. See the appropriate pathogen-specific section in this manual for more information.
- ***Incubation Period*** – Seven to fourteen days after onset of diarrhea (rarely 2-3 weeks).
- ***Clinical Illness*** – HUS is a severe medical condition characterized by microangiopathic hemolytic anemia, thrombocytopenia (low platelet count), and acute renal failure. It typically manifests two weeks after the onset of diarrhea. Symptoms of HUS can include vomiting, bloody diarrhea, stomach pain, fever, chills, abdominal pain, and headache. Individuals may experience fatigue, weakness, fainting, bruising, and paleness as the infection progresses. HUS can lead to complications such as high blood pressure, seizures, blood clotting problems, kidney disease, stroke, or coma. Patients with HUS may also develop neurologic complications such as seizures, coma, or cerebral vessel thrombosis.

- ***Laboratory Testing*** – See the appropriate pathogen-specific section in this manual for more information.
- ***Treatment*** –Close monitoring and treatment of symptoms are essential to prevent HUS. Approximately 50% of patients require dialysis, and 3%-5% of HUS cases die.
- ***Priority*** **–** High; prompt investigation is required.

Note: Adults with HUS are often misdiagnosed as having thrombotic thrombocytopenic purpura (TTP), a different thrombotic micrangiopathy unrelated to STEC. TTP can include central nervous system (CNS) involvement, fever, and a gradual onset; without CNS involvement and fever, criteria for clinically diagnosing cases as post-diarrheal TTP also meet the criteria for HUS and should be reported as such.

Quick References / Factsheets

- Hemolytic Uremic Syndrome – National Kidney Foundation

Forms

- Disease Case Report (CD-1) PDF format Word format
- Record of Investigation of Enteric Illness (CD-2C)
- Hemolytic Uremic Syndrome Investigation Report
- Missouri Outbreak Report Form (MORF)
- Child Care Establishment Inspection Related to Enteric Infection (CD-8)

Notifications

- Contact the District Epidemiologists or the Missouri Department of Health and Senior Services (MDHSS) – Bureau of Communicable Disease Control and Prevention (BCDCP), phone (573) 751-6113, or for afterhours notification contact the MDHSS – Emergency Response Center (ERC) at (800) 392-0272 (24/7) immediately if a case of HUS is identified in a foodservice worker or other high-risk setting.
- If a case(s) is associated with a childcare center, BCDCP or the LPHA will contact the MDHSS – Bureau of Environmental Health Services (BEHS), phone (573) 751-6095, Fax (573) 526-7377 and the Missouri Department of Elementary & Secondary Education (DESE) Office of Childhood/Child Care Compliance, phone (573) 751-2450, Fax (573) 526-5345.
- If a case(s) is associated with a food handler, BCDCP or the LPHA will contact BEHS, phone (573) 751-6095, Fax (573) 526-7377.
- If a case(s) is associated with a long-term care facility, BCDCP or the LPHA will contact the MDHSS - Section for Long Term Care Regulation, phone (573) 526-8524, Fax (573) 751-8493.
- If a case(s) is associated with a hospital, hospital-based long-term care facility or ambulatory surgical center, BCDCP or the LPHA will contact the MDHSS - Bureau of Health Services Regulation, phone (573) 751-6303, Fax (573) 526-3621.

- Contact the Missouri Department of Natural Resources, Public Drinking Water Branch, at (573) 751-1300, Fax (573) 751-3110 if cases are associated with a public water supply, or BEHS, phone (573) 751-6095, Fax (573) 526-7377, if cases are associated with a private water supply.

Reporting Requirements

- HUS is a Category 2 (A) disease and shall be reported to the local health authority or to the MDHSS within one (1) calendar day of first knowledge or suspicion; for afterhours notification contact the MDHSS - ERC at (800) 392-0272 (24/7).
- HUS reporting includes the following:
  1. For all cases, complete a "Disease Case Report" (CD-1).
  2. For confirmed and probable cases, complete the "Hemolytic Uremic Syndrome Investigation Report" and the "Record of Investigation of Enteric Illness" (CD-2C).

Laboratory Testing and Diagnosis

Laboratory criteria include anemia with microangiopathic changes and renal injury; see the case definition for more information. Patients with HUS should be tested for enteric pathogens, including STEC, *Shigella*, and *Campylobacter*. In addition, testing for the presence of Shiga toxin should be done. The absence of STEC or Shiga toxin in feces does not preclude the diagnosis of STEC-associated HUS, since HUS typically is diagnosed a week or more after onset of diarrhea, when the organism may no longer be detectable in stool.

Note: For more information on testing for enteric pathogens, see the appropriate pathogen-specific section of this manual.

Conducting the Investigation

1. **Verify the diagnosis**. Contact the provider and/or laboratory as needed to obtain demographic, clinical and laboratory information needed to determine whether the patient meets the case definition.
2. **Establish the extent of illness.** Determine whether household or other close contacts are, or have been, ill with diarrhea, by contacting the provider, patient, or family member. If persons with diarrhea are identified, see the appropriate pathogen-specific section.
3. **Identify potential sources of exposure.** Contact the case and ask about potential exposures 1-10 days before onset of illness, including the following exposures:
   - Case or a member of the case's household, have contact with diapered children, with children in child care or other settings for preschool children, or with staff of these facilities.
   - Case or a member of the case's household, work as a food handler, health care provider, or in animal operation.
   - Any restaurant or other food service meals.
   - Any social gathering or other group setting where the case ate a meal.

- Contact with livestock or other animals, including pets.
- Preparation or consumption of undercooked meat, including ground meat, beef, pork or poultry products.
- Consumption of unpasteurized milk, other dairy products, or fruit juices.
- Travel to an area where a known outbreak is occurring.
- Case is related to a food recall.

4. **Review surveillance data**. Determine whether there have been other cases in the same geographic area or institution. When cases are related by person, place, time, or whole genome sequencing (WGS) patterns, efforts should be made to identify a common source
5. **Provide information regarding the prevention of HUS and its causes to the case.**
6. **Identify exposed close contacts and potential settings for transmission.** Ask the case to verify specifics of illness and identify persons with significant opportunity for fecal-oral exposure during the entire period of communicability.

Control Measures

There are no specific control measures for HUS. However, if enteric tests are positive or the case of HUS is epidemiologically linked to a case of a specific pathogen, the control measures for that specific pathogen should be followed. See the appropriate pathogen-specific section of this manual.

General recommendations include:

- Wash your hands often with soap, especially before eating, after using the bathroom, or being around farm animals.
- Wash raw fruits and vegetables under running before eating, especially if they will be consumed without cooking. If possible, peel raw fruits before consumption.
- Cook ground beef to an internal temperature of 70°C (160°F). Use a meat thermometer, do not rely on color.
- Use separate cutting boards and plates for raw and cooked meat and avoid reusing plates that have come into contact with raw meat.
- When handling raw meat, prevent cross-contamination by washing hands, counters, cutting boards, and utensils thoroughly afterward.
- Do not prepare food that others will eat, attend daycare, or bathe or swim with others when having diarrhea.
- Avoid raw milk, unpasteurized dairy products, and unpasteurized juices (such as fresh apple cider).
- Persons with diarrhea due to HUS should not use recreational water venues for 2 weeks after symptoms resolve.
- Childcare centers, petting zoos, and animal displays should maintain good hygiene and encourage frequent handwashing with soap.

Resources

1. American Academy of Pediatrics. Escherichia coli/Diarrhea. In: Kimberlin DW, Brady MT, Jackson MA, Long SS, eds. *Red Book*: *2018 Report of the Committee on Infectious Diseases. 32nd ed.* Itasca, IL: American Academy of Pediatrics; 2021: 668-672.
2. American Public Health Association. E. coli Diarrheal Diseases. In: Heymann DL (ed), *Control of Communicable Diseases Manual.* 21st ed.Washington, D.C. American Public Health Association, 2022: 163-168.
3. CDC. National Notifiable Diseases Surveillance System (NNDSS) and Case Definitions: Hemolytic Uremic Syndrome, Post-diarrheal (HUS). Hemolytic Uremic Syndrome, Post-diarrheal (HUS) 1996 Case Definition | CDC (10/2023).
4. LaRocque, RC and Harris, JB. Syndromes of Enteric Infection. In: *Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases.* 9th ed. Philadelphia PA: Elsevier Suanders, 2020:1330-1339.
5. Razzaq, S. Hemolytic Uremic Syndrome: An Emerging Health Risk. *Am Fam Physicians.* 2006 Sep 15;74(6):991-996. https://www.aafp.org/afp/2006/0915/p991.html
6. Trachtman H. HUS and TTP in Children. *Pediatr Clin North Am*. 2013;60(6):1513-26. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3972058/.
7. Centers for Disease Control and Prevention. (2017, September 20). How to prevent *E. coli* infection. Centers for Disease Control and Prevention. https://www.cdc.gov/ecoli/prevention/index.html.