

# Hemolytic Uremic Syndrome

**Larry Greenbaum, MD, PhD, FAAP**

Marcus Professor of Pediatrics

Chief, Division of Pediatric Nephrology

Emory School of Medicine

Executive Clinical Director, Children's Healthcare of Atlanta

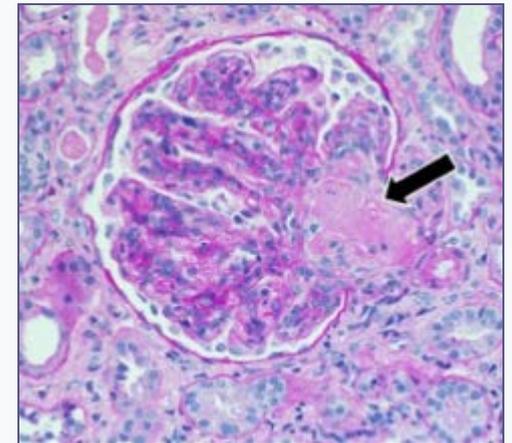
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# Hemolytic Uremic Syndrome (HUS)

Hemolytic uremic syndrome is a rare but devastating disorder affecting both children and adults.

- HUS is a thrombotic microangiopathy in which thrombi form in the smallest blood vessels, ie, capillaries and arterioles.
- It is characterized by the presence of:
  - ✓ hemolytic anemia
  - ✓ thrombocytopenia
  - ✓ acute kidney injury



# Categories of HUS

There are two broad categories of hemolytic uremic syndrome.

## Typical HUS (tHUS)

- Most commonly occurs in children
- Also occurs in infected adults
- Accounts for up to 90% of HUS cases, varying by region

## Atypical HUS (aHUS)

- Occurs in both children and adults
- Represents about 10% of HUS cases, depending on etiology

*Etiology, treatment, and outcomes differ markedly between typical HUS and atypical HUS.*

# 1 Etiology and Features

## Typical HUS

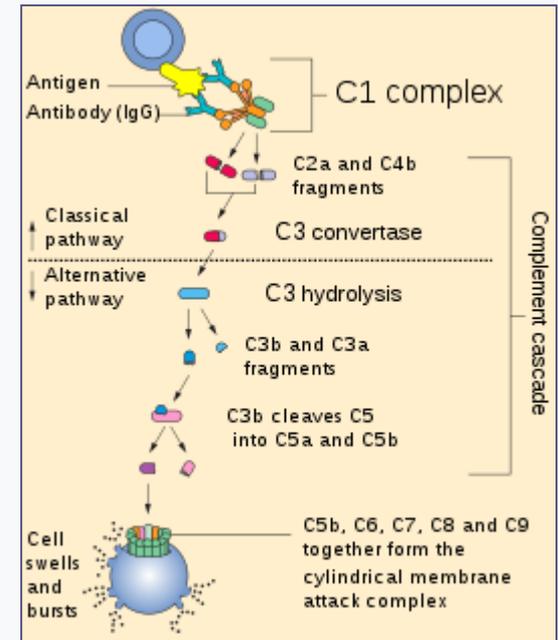
- tHUS is caused by Shiga toxin-producing *E coli* (STEC).
- Most patients have preceding illness with bloody diarrhea caused by STEC.
- About 10-15% with STEC gastroenteritis develop tHUS.
- Ischemia due to the microthrombi causes acute kidney injury in over 70% of tHUS patients.
- Microthrombotic ischemia occurs in other organs, including the brain, and is a major cause of mortality.



# Etiology and Features

## Atypical HUS

- aHUS has multiple etiologies.
- The most common etiology is probably derangements in the complement cascade of the immune system.
- The derangement may be due to gene mutations in proteins that regulate complement or the production of autoantibodies against complement.
- Other causes of aHUS include non-STEC infection, adverse effects of drugs, other genetic disorders, bone marrow transplants, malignancy, and SLE.



## 2 Treatment

### Typical HUS

Treatment for tHUS consists of supportive care:

- Anemia is treated with blood transfusion as needed.
- Acute kidney injury is treated by maintaining fluid and electrolyte balance and controlling blood pressure, plus dialysis as needed.
- Parenteral nutrition may be given for gastroenteritis or pancreatitis.
- Anticonvulsants are given if seizures develop.

Antibiotics are *not* given for the underlying *E coli* infection, as some studies have suggested this may actually cause harm.

# Treatment

## Atypical HUS

Treatment for aHUS depends on the particular underlying etiology.

### *Due to complement derangements caused by gene mutations*

- Treatment consists of monoclonal antibody complement inhibitors, specifically eculizumab and ravulizumab.

### *Due to autoantibodies directed against complement*

- Treatment includes the same monoclonal antibodies.
- Immunosuppression and plasmapheresis are also used as needed.

Due to known risk of meningococcal infection with the medications, vaccines are administered and prophylactic antibiotics are given.

# Treatment

## Atypical HUS

### Due to other causes

- Treatment varies widely depending on the cause.
- It may include treating the underlying condition, eg, SLE, or adjusting the drug causing the adverse effect.

***plus***

### Supportive treatment

- Acute kidney injury is treated by maintaining fluid and electrolyte balance and controlling blood pressure, plus dialysis as needed.

# 3 Outcomes

## Typical HUS

Following treatment, tHUS resolves and does not recur, although some patients have long-term issues, including CKD.

- About 70% of patients have no major sequelae and require no further treatment or management.
- Most patients recover renal function, although some develop CKD and a small percent develop ESRD.
- ESRD post-tHUS can be treated with kidney transplant as there is almost no risk of tHUS returning.

# Outcomes

## Atypical HUS

Because underlying genetic abnormalities cannot be corrected or addressed, many patients with aHUS remain at significant risk after resolution of the acute episode.

- Long-term monitoring is needed to manage many aHUS patients.
- Many aHUS patients also require long-term or life-long treatment with monoclonal antibody complement inhibitors to prevent recurrence of aHUS.

# Documentation Points

## Typical HUS

## Atypical HUS

Abbreviation

tHUS, STEC-HUS

aHUS

Inpatient  
Treatment

Supportive

Eculizumab (Soliris)  
Ravulizumab (Ultomiris)

Inpatient  
antibiotics

No

Yes, with meningococcal  
vaccine

Follow up or  
continuing  
care for HUS

No

Yes

# Hemolytic Uremic Syndrome

*Thank you!*

