

Shiga toxin-producing *Escherichia coli* (STEC) infection

Why this leaflet about STEC?

STEC-related diseases are rare in the paediatric population but can have serious health consequences for children, their families, and the community. This leaflet aims to help paediatricians deal with infections in children, and assist families in preventing STEC infections (see inside).

What are Shiga toxin-producing *Escherichia coli* (STEC)?

Shiga toxin-producing *Escherichia coli* (STEC) are an important pathogenic group among diarrheagenic *E. coli* or DEC (Table 1). They owe their name to their capacity to produce Shiga toxins, of which two antigenic variants are known – Stx1 and Stx2 – as well as several subtypes. Shiga toxins are primarily responsible for the clinical symptoms of systemic disease.

What are the symptoms of STEC infections?

STEC infections typically occur with diarrhoea, often bloody, severe abdominal pain, and vomiting. This phase may resolve spontaneously after 3-4 days or evolve into a severe form (haemorrhagic colitis) or a very severe form (Haemolytic Uremic Syndrome - HUS), with anaemia, thrombocytopenia, and systemic multi-organ involvement. In such cases, symptoms may include anaemia, drowsiness, reduced urination, widespread oedema, weight gain, jaundice, and seizures.

Who is at risk of developing STEC disease?

Anyone can be at risk of STEC infection, but children under five years are at higher risk of developing severe illness. In adults, the infection may be mild or asymptomatic.

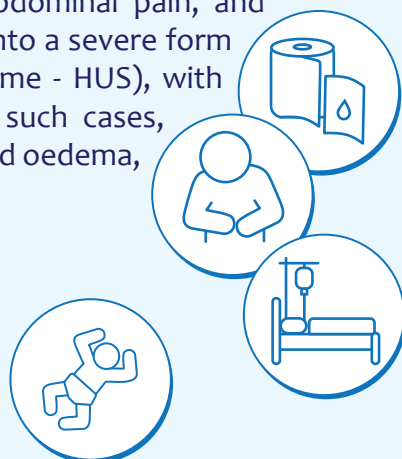


Table 1. Diarrheagenic *Escherichia coli* pathotypes (DEC)*

<i>E. coli</i> pathotypes	Marker Genes	Pathogenesis	Other information
STEC Shiga toxin-producing	<i>stx1, stx2 (eae)</i>	Production of Shiga toxins (Stx-1 and Stx-2)	Agent of Haemolytic Uremic Syndrome
EPEC Enteropathogenic	<i>eae</i>	Intimate adhesion to the intestinal mucosa and AE lesion	
ETEC Enterotoxigenic	<i>lt, st</i>	Production of heat-stable (St) and heat-labile (LT) enterotoxins	Causal agent of "traveller's diarrhoea"
EAEC Enteroaggregative	<i>aggR, aaiC, aggA, aafA, agg3A, agg4A, agg5A, CS22</i>	Adhesion to the intestinal epithelium	
EIEC Enteroinvasive	<i>ipaH</i>	Invasion and destruction of colonic epithelial cells	Pathology very similar to that caused by Shigella
DAEC Diffuse-adherence	<i>afaB, afaC</i>	Adhesion to the plasma membrane of enterocytes, inducing a cytopa- thic effect	

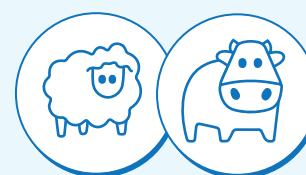
* This classification follows a general criterion. There are hybrid diarrheagenic *E. coli* that share virulence mechanisms typical of more than one pathotype

What to do in the case of suspected STEC infection?

A case of bloody diarrhoea in children may suggest a STEC infection.

If the paediatrician suspects this:

- ▶ Promptly send a stool sample to the lab for STEC testing through molecular methods (PCR/Real-Time PCR) targeting the *stx1, stx2* genes. Other methods may not offer the same sensitivity, with a risk of false negatives
- ▶ Antibiotic therapy is generally not recommended for patients with STEC infections, as it could worsen the patient's condition
- ▶ Consult a regional paediatric nephrology unit, or specialized paediatric centre, for daily clinical monitoring of the patient. This usually includes monitoring urine volume and output and conducting daily tests for microhaematuria and proteinuria, and possibly a complete blood count
- ▶ Extend STEC testing to the stools of all family members and close contacts of the child, even in the absence of symptoms, and provide guidance on hygiene measures to prevent spread to other individuals
- ▶ Keep the child away from community settings (nurseries, leisure centres, etc.)
- ▶ Notify the competent health authority about confirmed cases

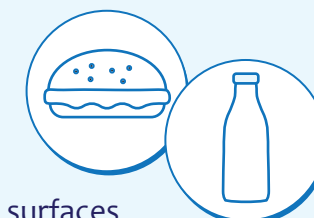


How are STEC infections transmitted?

STEC are zoonotic agents, with domestic (cattle, sheep, and goats) and wild ruminants as their main animal reservoirs.

Transmission to humans may occur via several routes:

- ▶ Consumption of contaminated foods, such as:
 - Raw or undercooked meats and meat products (e.g. hamburgers)
 - Raw unpasteurized milk, and dairy products made from raw milk
 - Unwashed and raw vegetables and fruit
- ▶ Direct contact with infected animals or indirect contact through surfaces contaminated by their faeces, such as soil or footwear (an important transmission route related to educational and leisure activities at farm schools or during farm stays).
- ▶ Drinking of accidentally contaminated water. Group leisure activities, such as using home pools, may pose a risk.
- ▶ In community settings with young children, such as nurseries or homes, STEC can easily spread from person to person via the faecal-oral route.



Haemolytic Uremic Syndrome (HUS)

In systemic forms of the disease, Shiga toxin released by STEC crosses the intestinal barrier and reaches target organs through the bloodstream, particularly the endothelial cells of the renal and cerebral microvessels, triggering HUS.

HUS is a thrombotic microangiopathy characterized by mechanical haemolytic anaemia, thrombocytopenia, and kidney disease. This may manifest with haematuria and proteinuria with preserved or slightly reduced renal function, up to acute oligoanuric renal failure. Neurological complications (disturbance of consciousness, seizures, pyramidal and extrapyramidal syndromes, visual disorders, and coma) are often associated with a very severe clinical picture, even fatal.

In the long term, HUS can lead to severe sequelae, mainly renal, but also extra-renal. The most common symptom is hypertension. 30-40% of individuals affected with HUS may develop chronic kidney disease, usually mild, but in severe cases they may require dialysis and kidney transplantation.