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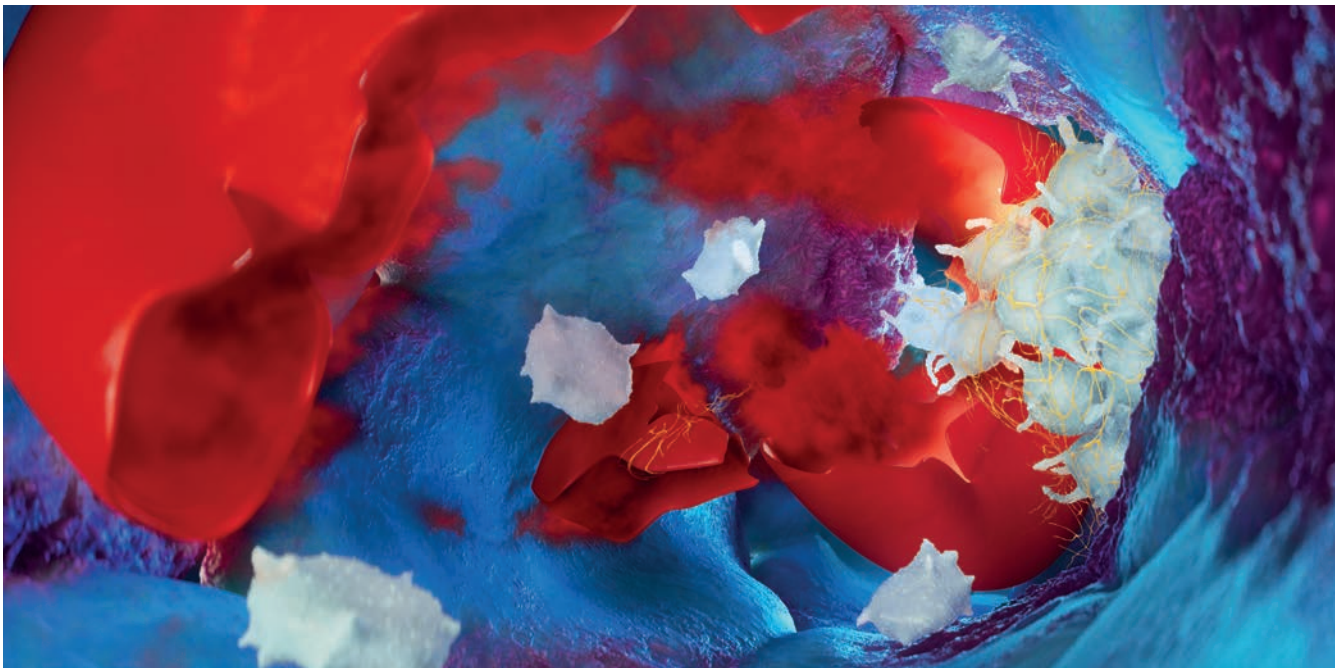
HAEMATOLOGY | July 2023

Infection

Haemolytic uraemic syndrome caused by Shiga toxin-producing *E. coli*



Clinical information and laboratory results

A two-year-old patient presented at the hospital with watery stool, which later became bloody with fever appearing.

The blood count showed an HGB of 6.8 g/dL (4.22 mmol/L), resulting in an 'Anaemia' flag on the analyser and a PLT-F count of 27 $\times 10^9$/L triggering the 'Thrombocytopenia' flag. On day 4 after admission, schistocytes were present at 4.0 % on the blood smear.

Testing results further showed acute kidney injury and elevated lactate dehydrogenase (LD), as well as an increase in WBC and C-reactive protein (CRP). This led to the suspicion of HUS. Antibodies to *Escherichia coli* O157 lipopolysaccharide were found, confirming the diagnosis of haemolytic uraemic syndrome (HUS) due to Shiga toxin-producing *E. coli*.

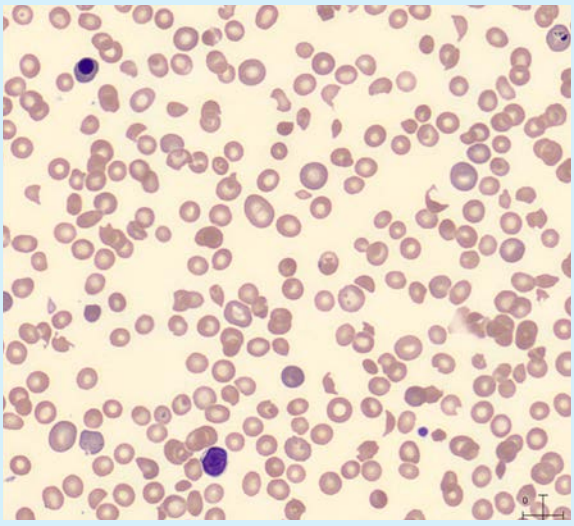


Fig. 1 *Red blood cells classified as schistocytes by the Advanced RBC Application of the DI-60, an automated digital imaging analyser. The blood sample was obtained and analysed on day 5 after admission.*

Result interpretation

Escherichia coli strain 0157 is a type of enterohaemorrhagic *E. coli* (EHEC) [1] that is known to cause haemolytic uraemic syndrome (HUS). It colonises the gastrointestinal tract and produces a cytotoxin called Shiga toxin or Stx [2]. Stx can lead to a remodelling of cell expression. This can result in activation of platelets [3], expression of adhesion molecules [4] and inflammatory chemokines [5]. The cytotoxic effect of Stx is potentiated, promoting the adhesion of WBC to endothelial cells, causing thrombosis and tissue damage. Thrombosis in the capillaries subsequently leads to mechanical haemolysis [6], so patients present with fragmented RBC as well as decreased platelet counts.

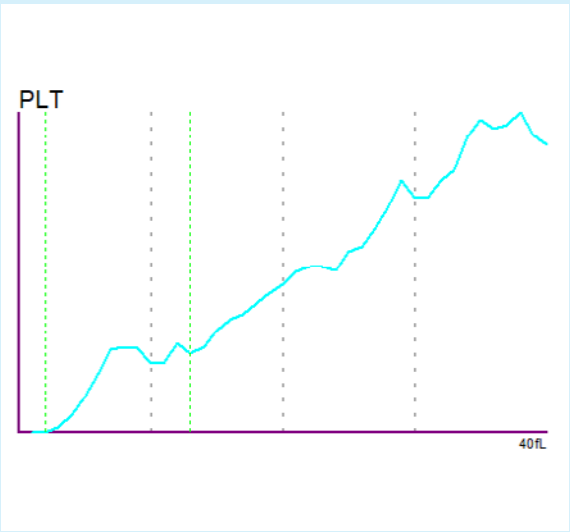


Fig. 2 *The patient's PLT histogram showing interferences at the upper discriminator on day 5 after admission.*

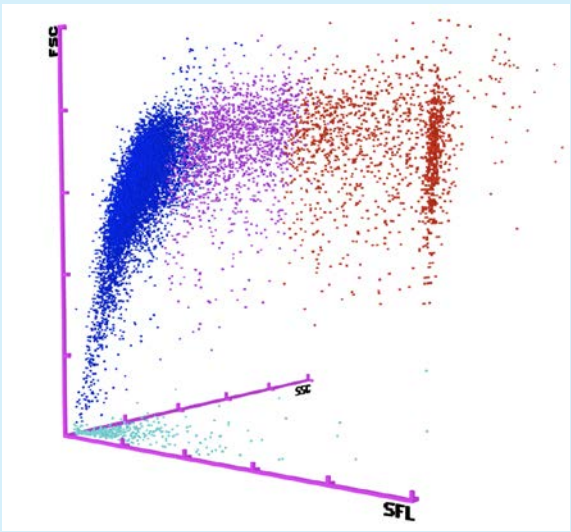


Fig. 3 *RET scattergram with an RBC population (blue) extended towards the low FSC area, indicating fragmented RBC.*

References

[1] Gambushe SM et al. (2022): *Review of Escherichia coli O157:H7 Prevalence, Pathogenicity, Heavy Metal and Antimicrobial Resistance, African Perspective. Infect Drug Resist. 15: 4645–4673.*

[2] Tarr PI et al. (1995): *Escherichia coli O157:H7: Clinical, Diagnostic, and Epidemiological Aspects of Human Infection. Clin Infect Dis. 20(1): 1-10.*

[3] Karpman D et al. (2001): *Platelet activation by Shiga toxin and circulatory factors as a pathogenetic mechanism in the hemolytic uremic syndrome. Blood. 97(10): 3100–3108.*

[4] Morigi M et al. (1995): *Verotoxin-1 promotes leukocyte adhesion to cultured endothelial cells under physiologic flow conditions. Blood. 86(12): 4553–4558.*

[5] Zoja C et al. (2002): *Shiga toxin-2 triggers endothelial leukocyte adhesion and transmigration via NF-kappaB dependent up-regulation of IL-8 and MCP-1. Kidney Int. 62(3): 846–856.*

[6] Bommer M et al. (2018): *The Differential Diagnosis and Treatment of Thrombotic Microangiopathies. Dtsch Arztebl Int. 115(19): 327–334.*