Nodular regenerative hyperplasia (NRH) of the liver is a rare disorder that is often associated with connective tissue disorders, haematological malignancy, or drugs, and is a cause of non-cirrhotic portal hypertension. We describe two cases of NRH in individuals with adult coeliac disease and IgA anticardiolipin antibodies. We discuss the potential impact of this observation on the understanding of the pathogenesis of NRH.

Case 1
A 55 year old female presented with ascites, weight loss, and thrombocytopenia (76×10⁹/l). Having been diagnosed with coeliac disease 24 years earlier, compliance with a gluten free diet had been suboptimal. Her liver function tests were abnormal (AST 114 (normal range 5–43), ALP 668 (normal range 17–330), bilirubin 39 µmol/l (normal range 5–43), albumin 32 g/l (normal range 34–51), INR 1.3). The spleen was not enlarged and the portal vein was patent. A computed tomography scan of the chest and abdomen did not identify lymphadenopathy and the hepatic veins were patent. The hepatic venous pressure gradient measured 10 mm Hg. A liver biopsy demonstrated foci of NRH with loss of portal vein branches.

In addition, features of a chronic biliary process were present but not suggestive of primary biliary cirrhosis. There was no evidence of cirrhosis. A biopsy taken five years earlier at the referring hospital showed an identical process. Following liver biopsy, she developed intractable haemorrhage with features of disseminated intravascular coagulation and died.

Case 2
A 35 year old male presented with ascites, weight loss, and thrombocytopenia (42×10⁹/l). A liver biopsy demonstrated NRH and he was diagnosed with coeliac disease on duodenal biopsy the following year. He took a gluten free diet intermittently and suffered episodic ascites and confusion. Age 43 years, he was referred for liver transplantation but prior to assessment suffered a stroke (right parietal lobe infarct). His liver function tests were abnormal (AST 114 (normal range 5–43), ALP 668 (normal range 17–330), bilirubin 39 µmol/l (normal range 5–43), albumin 32 g/l (normal range 34–51), INR 1.3). He remained positive for IgA endomyosalis antibodies and duodenal biopsy demonstrated persistent subtotal villous atrophy. The liver was small but he improved slowly on a strict gluten free diet. Acute portal vein thrombosis precipitated a further deterioration and he died.

DISCUSSION
We have reported two cases of NRH associated with IgA aCL and longstanding coeliac disease (poor dietary compliance). Our current understanding of NRH is that obliteration of small portal branches causes atrophy of downstream lobules and initiates compensatory hyperplasia in adjacent lobules with an intact portal venular supply. A number of thrombo-philic disorders, including polycythaemia vera, primary thrombocytethmia, protein S deficiency, and IgG antiphospholipid syndrome (APS) are associated with NRH. APS is a systemic autoimmune disorder characterised by a combination of arterial and/or venous thrombosis or recurrent pregnancy loss, and thrombocytopenia with the presence of elevated titres of aPL antibodies. aPL are autoantibodies directed against anionic phospholipids or protein/ phospholipid complexes (commonly containing β2 glycoprotein I (β2-GPI) or prothrombin, but also protein C, protein S, and annexin V) measured in solid phase immunoassays as aCL.

Abbreviations: NRH, nodular regenerative hyperplasia; aCL, anticardiolipin antibodies; aPL, antiphospholipid antibodies; APS, antiphospholipid syndrome; AST, aspartate aminotransferase; ALP, alkaline phosphatase; INR, international normalised ratio; β2-GPI, β2 glycoprotein I.
antibodies or detected in phospholipid dependent clotting tests as lupus anticoagulant. 

In the cases described here, aCL antibodies were associated with abnormal thrombosis, bleeding, and prolonged persistent thrombocytopenia in the absence of other features of hypersplenism. The exact mechanism by which aCL antibodies are produced is unclear. Anionic phospholipids (for example, phosphatidylserine) are regular constituents of the inner leaflet of the cell membrane that are only exposed on the outside of the cell membrane during apoptosis, or by damaged endothelial cells and activated platelets during blood coagulation. In the latter situation, membranes containing phosphatidylserine provide the catalytic surface that serves as a point of assembly for the prothrombinase complex. In an animal model, systemic exposure to apoptotic cells induced the formation of aCL. We postulate that apoptosis is the link between coeliac disease and an aPL associated vasculopathy which leads to NRH. Coeliac disease is caused by an abnormal T cell mediated inflammatory response to dietary gluten and the hallmark autoantibody is produced against the tissue and cell associated protein transglutaminase. The mechanism thought to evoke this anti-self antibody begins with transglutaminase cross linking and forming a complex with gliadin which is rich in glutamine. Transglutaminase specific B cells take up gluten/ transglutaminase complexes and present T cell epitopes to gluten specific T cells, resulting in T cell help for the production of antibodies against the self-protein transglutaminase. 

Transglutaminase is also expressed in apoptotic cells where it cross links glutamine residues in membrane proteins, thereby protecting apoptotic cells from disintegrating and releasing their contents. We hypothesise that when this process occurs in apoptotic enterocytes during active ing and releasing their contents. We hypothesise that when proteins, thereby protecting apoptotic cells from disintegrat-

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<th>Table 1 Results of anticardiolipin antibody and anti-β2 glycoprotein 1 antibody assays in the two patients</th>
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NR, normal range.

lymphoid tissue. The concentration of IgA aCL would be expected to be higher in portal venous blood compared with the systemic circulation, and portal vein radicles would be the most likely site to be affected by thrombotic complications.

In conclusion, we have described two cases of NRH associated with IgA aCL and evidence of poorly compliant coeliac disease. We suggest T cell help from gluten specific T cells is responsible for driving the IgA autoantibody response to both transglutaminase and protein/phospholipid complexes, leading to the formation of IgA aCL. IgA aCL then trigger thrombosis in small portal vein radicles, which drain the inflamed small intestine, leading to liver injury with consequent hyperplasia of the surrounding tissue. This observation adds to the list of prothrombotic conditions such as primary myeloproliferative disorders, anticoagulant protein deficiencies, and APS associated with non-cirrhotic portal hypertension.

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**References**


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