these unexpected results. We are also questioning about differences in the PB medication among the 11 participating countries.

After investigating the reasons for the very low numbers of PB prescription, we strongly suggest a separate analysis of the patients on the basis of the PB medications and the serum phosphate level to understand the association of these parameters with the outcomes. Apart from some particular dialysis schedule including long and/or daily strategies, phosphataemia remains an important marker of nutrition in cases of conventional HD. The use of PBs could be associated with a better outcome when associated with a higher protein intake, but this remains a speculation.

We encourage the ARO investigators to provide more observational data from European countries to improve our understanding of the association between mineral metabolism disorders, their treatments and outcomes.

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In our population, we observed a significant interaction between phosphate level, phosphate binder use and mortality (P = 0.02). As can be seen in Table 1, this interaction is being driven by the lack of an association between low phosphate levels and mortality in those treated with a phosphate binder compared to those untreated.

In principle, this observation is consistent with the data of Isakova et al. [1], who noted a reduced mortality in haemodialysis patients treated with a phosphate binder. However, in that study, most of the benefit was observed in patients with high phosphate levels, whereas in our study patients treated to low phosphate levels appeared to benefit most from a phosphate binder.

**Conflict of interest statement.** None declared.

**Table 1.** Association between phosphate levels and mortality in the ARO population according to whether or not a participant is taking a phosphate binder at baseline

<table>
<thead>
<tr>
<th>Phosphate (mmol/L)</th>
<th>Not taking phosphate binders</th>
<th>Taking phosphate binders</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1.13</td>
<td>1.29 (1.08–1.55)</td>
<td>1.00 (0.75–1.34)</td>
</tr>
<tr>
<td>1.13–1.78</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>&gt;1.78</td>
<td>1.32 (1.07–1.64)</td>
<td>1.33 (1.04–1.71)</td>
</tr>
</tbody>
</table>

*Adjusted for demographics (age, gender, country, body mass indexBMI, smoking status), medical history (chronic kidney disease aetiology, history of diabetes, history of cardiovascular disease (CVD), history of Cancer), dialysis parameters (vintage, vascular access type, Kt/V, blood flow), markers of inflammation (serum albumin, C-reactive protein), CVD medications (anthypertensive drugs, ACE inhibitors, oral anticoagulants, anti-aggregants), vitamin D use and other lab parameters (PTH, calcium, haemoglobinHb, ferritin, cholesterol, blood leucocytes) and miscellaneous (hospitalization, change in vascular access type).


Advance Access publication 23 March 2011

**Is there a link between thrombotic thrombocytopenic purpura and anti-glomerular basement membrane disease?**

Sir,

We read with interest the article by Torok et al. [1]. They reported a 43-year-old Caucasian male who had developed thrombotic thrombocytopenic purpura (TTP) followed by anti-glomerular basement membrane (anti-GBM) disease...
They described that multiple autoimmune diseases could occur in the same patient as the theory of a ‘mosaic of autoimmunity’ but did not suggest the possible mechanisms [1].

Although not extensively studied yet, we speculate that the helper T (Th) cell-associated cytokine, interleukin (IL)-12, might be involved in the common pathogenesis between the two diseases [2,3]. Takatsuka et al. [2] showed that the patients with thrombotic microangiopathy had a significant increase of IL-12 at the time of leukocyte recovery after bone marrow transplantation (BMT) (P < 0.05), while none of the patients without microangiopathy showed an increase of IL-12. Kakishita also reported that TTP and haemolytic uraemic syndrome (HUS) after BMT might be predicted at an early stage by determining any increase in plasma IL-12 at the time of leukocyte recovery [3], suggesting the possibility that TTP might be related to inflammation or autoimmunity.

In addition, Kalluri et al. [4] developed a new mouse model of human anti-GBM disease, in which crescentic glomerulonephritis and lung haemorrhage were associated with the emergence of an IL-12/Th1-like T-cell phenotype. Conversely, Kitching et al. [5] demonstrated that IL-12p40−/− knockout mice were protected from renal injury in an experimental model of autoimmune anti-GBM glomerulonephritis. Therefore, there is a possibility that IL-12 might play an important role in the development of both TTP and anti-GBM disease and it would be interesting to measure IL-12 during the course of the disease in the patient of Torok et al. [1].

However, further studies are necessary to elucidate whether IL-12 is elevated in all kinds of TTP or HUS and whether it might also play an important role in the development of human anti-GBM disease. The relationship between IL-12 levels and the degree of ADAMTS13 deficiency or the titres of anti-GBM antibody should be further evaluated in the future.

Conflict of interest statement. None declared.

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Reply

Sir, Shin et al. letter lends an important perspective on a critical topic. We previously reported the simultaneous presentation of thrombotic thrombocytopenic purpura (TTP) and Goodpasture’s disease in the same patient. We agree completely that the pathogenic mechanism of TTP and Goodpasture’s disease was not identified in our case. We speculated the ‘mosaic of autoimmunity’ theory as an explanation of this association based on the accumulating evidence of the autoimmune nature of TTP [1] and Goodpasture’s disease.

However, transplant associated thrombotic microangiopathy (TA-TMA) is a different entity from TTP [2]. Pathologically, the thrombi in TA-TMA contain both fibrin and von Willebrand Factor, whereas in TTP, the thrombi consist mainly of platelets [3]. Suggesting that these diseases are different, this makes us believe that the underlying pathologic mechanisms might also be different. Besides, TA-TMA can be related to other causes, like Graft Versus Host Disease, to immunosuppressive medications side-effects and to viral infections which all can mimic TTP [4]. Therefore, high IL-12 levels preceding TA-TMA might not exactly fit TTP. Nevertheless, we still feel that it is interesting to extend this observation to TTP, and further studies are thus needed. Concerning Goodpasture’s disease, the interest has been shifted to IL-23 by Kitching et al., the same group who reported the protective role of IL-12 in the experimental knockout mouse model against the development of the disease [5]. In our case report, we did not have baseline IL-12 levels before or during the disease activity, which makes it impossible to confirm or dispute the relation between IL-12 and these entities.

We share the conclusion of Kim et al. that further research focusing on the possible autoimmune mechanisms in TTP and anti-GBM disease, specifically the relation with IL-12, is needed. What we know about these intriguing entities is less than what we do not know.

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