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Serum levels of BAFF, but not APRIL, are increased after rituximab treatment in patients with primary Sjögren’s syndrome: data from a placebo-controlled clinical trial

B cell depletion therapy with rituximab (RTX; 2 weekly infusions of 1000 mg, premedication: 100 mg prednisolone) in primary Sjögren’s syndrome (pSS) patients is effective in reducing subjective and objective symptoms. As B cell activating factor (BAFF) and a proliferation-inducing ligand (APRIL) are important cytokines involved in B cell survival and activation, we assessed in pSS patients included in a double-blind, randomised, placebo-controlled trial the effects of RTX on serum BAFF and APRIL levels up to 48 weeks after RTX.

Serum concentrations of BAFF and APRIL were measured by ELISA using kits from R&D systems (Minneapolis, Minnesota, USA) and Bender Med Systems (San Diego, California, USA), respectively. At baseline serum BAFF levels were significantly higher in pSS patients (n=28; median 1277 pg/ml (range 907–3802 pg/ml)) compared with healthy controls (n=10; median 983 pg/ml (range 600–1564 pg/ml)); p<0.01; figure 1A). Also, baseline serum APRIL levels were significantly higher in pSS patients (median 15 098 pg/ml (range 1591–228 591 pg/ml)) than in healthy controls (median 1965 pg/ml (range 889–4567 pg/ml); p<0.05; figure 1B). After RTX, serum BAFF levels in pSS patients further increased when B cells were depleted from the circulation. When B cells reappeared, BAFF levels declined (figure 2A). In marked contrast, APRIL levels, which partly target the same receptors as BAFF, remained unaltered (figure 2B).

Binding of BAFF to the BAFF receptor (BAFF-R) plays a critical role in B cell homeostasis because binding of BAFF to the BAFF-R prevents apoptosis of the cells. Mature B cells excessively express BAFF-R; a decrease in B cell numbers will therefore lead to higher levels of unbound BAFF in serum and may favour survival of newly generated B cells. Upregulation of BAFF production by monocytes has been proposed as another mechanism for the rise in serum BAFF levels after RTX. In line with these findings, we observed an inverse relationship between serum BAFF levels and B cell numbers in patients after RTX. Furthermore, Pers et al demonstrated that higher baseline BAFF levels lead to a shorter period of B cell depletion after RTX. Elevated BAFF levels may also influence the stringency of B cell selection. Generation of B cells in an environment with high BAFF levels may therefore lead to more newly generated autoreactive cells. Moreover, BAFF is also involved in B cell activation and may lead to higher IgG levels. However, after RTX IgG levels decrease, although they remain elevated in comparison with healthy controls, while BAFF levels increase. Therefore, we consider it unlikely that higher BAFF levels, seen after RTX, result in hyperactivation of persisting B cells.

In contrast to BAFF, APRIL levels remained unchanged after RTX. This can be explained by the notion that the major receptors for APRIL, that is, transmembrane activator and calcium modulator and cyclophilin ligand interactor and B-cell maturation antigen, are largely restricted to activated B cells and to plasma cells, respectively. Numbers of activated B cells are relatively low, and plasma cells are largely unaffected by RTX. The persistently high APRIL levels may be involved in B cell activation of (activated) B cells and survival of plasma cells, herewith contributing to the elevated serum IgG levels in pSS patients, even after RTX.

To conclude, RTX has differential effects on BAFF and APRIL levels in pSS patients. In patients with systemic lupus...
Figure 2  Effect of placebo and rituximab (RTX) treatment on B cell activating factor (BAFF) (A) and a proliferation-inducing ligand (APRIL) (B) levels in Sjögren’s syndrome patients (placebo n=9; RTX n=19). BAFF levels increase after RTX, but not after placebo, whereas APRIL levels remain high after treatment. *Indicates significant differences compared with baseline values (p<0.05). The horizontal lines indicate median values.
erythematosus, rheumatoid arthritis and pemphigus vulgaris, BAFF levels also increase, while APRIL levels remain stable (rheumatoid arthritis, pemphigus vulgaris) or decrease (systemic lupus erythematosus). This suggests that increase in BAFF is a general phenomenon and not specific for pSS. Given the potential role of BAFF in pSS, combination of anti-BAFF treatment with RTX may lead to a prolonged reduction of (autoimmune) B cells. Since B cell reappearance after RTX correlates well with clinical relapse such an approach might be an appropriate treatment modality.

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