Improvement of Intravenous Immunoglobulin Therapy for Bullous Pemphigoid by Adding Immunosuppressive Agents

Marked Improvement in Depletion of Circulating Autoantibodies

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**Background:** Various antibody-mediated autoimmune disorders are treated with intravenous immunoglobulin (IVIg). While the exact action of IVIg is unknown, it likely acts to rapidly and selectively lower the level of pathogenic antibodies. The most effective use of IVIg, an expensive and potentially toxic treatment of autoimmune disorders, remains undetermined. We propose that the addition of immunosuppressive agents to the IVIg regimen may increase the ability of IVIg to lower the level of pathogenic antibodies.

**Observations:** For 16 months, we observed a 78-year-old patient with autoantibody-mediated bullous pemphigoid who was treated with IVIg and an adjuvant therapy on 2 separate occasions as well as IVIg alone on 2 other occasions. We observed the greatest depression of bullous pemphigoid antibodies when IVIg was combined with an immunosuppressive agent.

**Conclusion:** These results support the hypothesis that agents that suppress antibody synthesis can offset the rebound in the level of individual antibody that follows their depletion and thus can improve the effectiveness of IVIg treatment while reducing the cost and the potential toxic effects of therapy.

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**REPORT OF A CASE**

A 78-year-old patient with bullous pemphigoid, based on clinical, histologic, and
immunofluorescence criteria, recalcitrant to conventional treatment with systemic steroids and various adjuvant therapies (mycophenolate mofetil, dapsone, minocycline, and high-potency topical steroids) was treated with 19 cycles of IVIg over the course of 16 months. The patient was given IVIg every 2 to 4 weeks with or without an immunosuppressant agent (mycophenolate mofetil or azathioprine) while receiving tapering doses of systemic steroids. In addition, during the course of treatment, the patient continually used topical steroids and prophylactic vitamin D, calcium, and H2 blockers. Medical history included a seizure disorder for which the patient took phenytoin. The patient denied additional medications.

Serum level of IgG and IgG4 pemphigoid antibodies were measured by indirect immunofluorescence using monkey and guinea pig esophagus as the substrate and appropriate class-specific conjugates at each baseline and at least once 1 to 2 months later.

RESULTS

The patient was treated with IVIg with or without an immunosuppressive agent over a 20-month period (Figure 1) during which the systemic steroid dose was slowly tapered (Figure 2). The resulting changes in serum level of IgG and IgG4 pemphigoid antibodies are illustrated in Figure 1 and summarized in Figure 3. The most striking result is that serum pemphigoid autoantibody levels decreased during the 2 treatment periods (periods 2 and 4) that IVIg was administered with an immunosuppressant agent but increased during the 2 periods (periods 3 and 5) that it was given without such an agent (Figure 1). Antibody levels did not change on the 1 occasion when the patient was treated with high doses of steroids and mycophenolate mofetil without IVIg (treatment period 1).

TREATMENT PERIOD 1

In April 2005, the patient was treated with prednisone, 40 mg/d, and mycophenolate mofetil, 2 to 3 g/d. Serum titers of IgG and IgG4 pemphigoid antibodies were both 1280 at baseline and did not change during the ensuing 2 months. During this time the patient’s existing lesions showed some improvement but continued to flare.

TREATMENT PERIOD 2

In September 2005, while taking prednisone, 20 mg/d, and mycophenolate mofetil, 3 g/d, the patient was treated...
In August 2006, the patient was taking prednisone, 5 mg/d, when treatment began with 4 cycles of IVIg every 3 to 4 weeks. In addition, the prednisone dose was increased to 10 mg/d. No immunosuppressive agents were given. Serum pemphigoid IgG tier doubled in 1 month (from 160 to 320), and IgG and IgG4 titers both quadrupled within 3 months, from 160 to 640 and from 640 to 2560, respectively. During this time, the patient continued to develop lesions at an average rate of 1 new bulla per week.

The most important observation is that the addition of an immunosuppressive agent to IVIg treatment resulted in a much greater decrease in serum levels of pemphigoid autoantibodies than IVIg used alone. We had the unusual opportunity to observe the effects of IVIg given with or without an immunosuppressive agent on serum level of pemphigoid antibodies in the same patient with this disease. The disease was treated with multiple IVIg cycles given without an immunosuppressive agent on 2 occasions and with an immunosuppressive on 2 other occasions (azathioprine in one instance, mycophenolate mofetil in the other). On 1 occasion the disease was treated with mycophenolate mofetil without IVIg. In the 2 instances that IVIg was used without an immunosuppressive agent, there was either no change or an increase in serum levels of IgG and IgG4 pemphigoid antibodies after 3 to 4 cycles of therapy. By contrast, serum levels of IgG and IgG4 pemphigoid antibodies both decreased by an average of 70% after the same number of treatment cycles on the 2 occasions when IVIg was given with an immunosuppressive. This was not an effect of the immunosuppressive agent, as there was no change in serum level of pemphigoid antibodies when the patient was treated with the same doses of mycophenolate mofetil without IVIg. Furthermore, we have previously shown that there is little change in autoantibody levels in patients with pemphigus vulgaris treated with high-dose prednisone and an immunosuppressant drug. Also, these observations were made in the same patient; therefore, these differences could not have resulted from patient-to-patient variation in response to IVIg treatment. Nor are our observations the result of the tendency of pemphigoid to gradually improve over time; the course of treatment with or without an immunosuppressive agent was given on an alternating schedule.

These results support our hypothesis that agents that suppress antibody synthesis can offset the rebound in the level of individual antibody that follows its depletion and thus can improve the effectiveness of IVIg therapy. These findings are consistent with those of our group’s prior studies, which have shown that this rebound can be reduced in animals by using immunosuppressive agents that inhibit antibody synthesis. Our results are nearly identical to those reported previously that the rebound in antibody levels that follows pemphigus antibody depletion by plasmapheresis was suppressed by the concurrent administration of an immunosuppressive agent.

In late March 2006, while taking prednisone, 5 mg/d, the patient was treated with 3 cycles of IVIg every 2 weeks administered without an immunosuppressive drug. Serum titer of pemphigoid IgG (320) did not change during the ensuing month, while that of IgG4 doubled (from 2560 to 5120). During this time, the patient had 1 flare with several new bullae.

**TREATMENT PERIOD 4**

In late March 2006, while taking prednisone, 5 mg/d, the patient was treated with 3 cycles of IVIg every 2 weeks given together with azathioprine, 150 to 200 mg/d. The dose of prednisone was not changed. Two months later, after 4 cycles of IVIg treatment, serum titers of IgG and IgG4 had both decreased by 2-fold from 320 to 160 and from 2560 to 1280, respectively, and 3 months later, after 6 cycles, serum levels of IgG and IgG4 had both decreased 4-fold. Clinically, flares occurred during this time and several new bullae developed. No obvious correlation was noted between levels of bullous pemphigoid autoantibodies and disease activity.

**TREATMENT PERIOD 5**

In August 2006, the patient was taking prednisone, 5 mg/d, when treatment began with 4 cycles of IVIg every 3 to 4 weeks. In addition, the prednisone dose was increased to 10 mg/d. No immunosuppressive agents were given. Serum pemphigoid IgG tier doubled in 1 month (from 160 to 320), and IgG and IgG4 titers both quadrupled within 3 months, from 160 to 640 and from 640 to 2560, respectively. During this time, the patient continued to develop lesions at an average rate of 1 new bulla per week.

The most important observation is that the addition of an immunosuppressive agent to IVIg treatment resulted in a much greater decrease in serum levels of pemphigoid autoantibodies than IVIg used alone.

**TREATMENT PERIOD 3**

In February 2006, while taking a stable dose of prednisone, 5 mg/d, the patient was treated with 3 cycles of IVIg every 2 weeks administered without an immunosuppressive drug. Serum titer of pemphigoid IgG (320) did not change during the ensuing month, while that of IgG4 doubled (from 2560 to 5120). During this time, the patient had 1 flare with several new bullae.

**Figure 3. Comparison of effects of intravenous immunoglobulin (IVIg) administered with and without an immunosuppressive drug on serum levels of pemphigoid IgG (A) and IgG4 (B) antibody levels. Note that there was a marked decrease in serum levels of IgG and IgG4 antibodies on the 2 occasions when IVIg was combined with an immunosuppressant agent. By contrast, on the 2 occasions when IVIg was used without an immunosuppressive agent, serum IgG and IgG4 levels remained stable or increased.**
This concept is supported by several case reports of IVIg being clinically effective for the treatment of blistering diseases when given with an immunosuppressive agent\(^1\) and ineffective when such an agent was not used.\(^18,19\) It is further supported by reports that months are required for IVIg to lower serum levels of pemphigus antibodies when administered without an immunosuppressive agent,\(^20\) while the decline occurs in weeks if an immunosuppressive drug is used.\(^8\)

In summary, the coadministration of agents interfering with antibody production may improve the IVIg treatment of pemphigoid and more generally of other autoantibody-mediated diseases by reducing the amount of IVIg required to control disease activity and thus lessening the cost and potential toxic effects of this very expensive therapy.

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