Treating severe systemic lupus erythematosus with rituximab. An open study

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In most cases, we observed significant improvement in both clinical and laboratory parameters, with good tolerance and few side effects. Thus, patients with severe lupus nephritis showed improvement in disease activity (MEX-SLEDAI index) with a significant reduction (p < 0.05), as well as proteinuria in most of them (from 3.710 g/L to 1.786 g/L, p < 0.05); patients with serious neurologic involvement had complete remission of their manifestations; but those with pulmonary massive hemorrhage did not have any response. Rituximab could have an important therapeutic potential in severe SLE, and that is necessary to carry out a controlled blinded clinical trial to further support this point.

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\section*{Tratamiento del Lupus Eritematoso Severo con Rituximab. Un estudio abierto}

El lupus eritematoso sistémico es un padecimiento con bases autoinmunes que puede asociarse a elevada morbilidad y mortalidad. El curso es variable e impredecible, y aunque el pronóstico y la supervivencia de los pacientes han mejorado importantemente, la afectación multiorgánica puede representar un reto terapéutico. Dado que los linfocitos B tienen un papel protagónico en esta enfermedad, es esperable que como blanco del tratamiento, pueda resultar en un efecto terapéutico significativo en el lupus eritematoso. En este estudio clínico abierto, exploramos el potencial terapéutico de la administración de rituximab (un anticuerpo monoclonal) en pacientes con lupus grave; es necesario realizar un estudio clínico doble ciego controlado a largo plazo que ratifique nuestros hallazgos.

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\section*{Introduction}

Systemic lupus erythematosus (SLE) is a multiorgan autoimmune disease with heterogeneous clinical manifestations and unpredictable disease course.\textsuperscript{1} Although the prognosis and survival of SLE patients have dramatically improved, the treatment of severe multiorgan affectation remains as a therapeutic...
Severe nephritis, transverse myelitis and massive pulmonary hemorrhage are three of the most serious manifestations of SLE. These conditions are associated with high morbidity and mortality, including those events that are consequence of the immunosuppressive therapy.  

Different abnormalities of T and B lymphocytes are involved in the pathogenesis of SLE. B lymphocytes synthesize several cytokines involved in the pathogenesis of SLE (including IL-10), have an important role as antigen presenting cells, and are the source of the different auto-antibodies detected in these patients. Therefore, B lymphocytes have been considered as a good therapeutic target in SLE. Rituximab is a chimeric monoclonal antibody, with human IgG1 and kappa light chain constant domains, and mouse variable regions from a mouse hybridoma producing an anti-human CD20 antibody. CD20 is expressed by immature and mature B lymphocytes, but not by early B cell precursors or plasma cells. This biological agent causes B-cell depletion in vivo, inducing complement and antibody dependent cellular toxicity as well as antibody mediated apoptosis. Interestingly, administration of Rituximab does not seem to have a significant effect on serum immunoglobulin levels, but its administration could be associated with diminution of autoantibody levels.  

There are different preliminary studies on the therapy of SLE and other autoimmune diseases with Rituximab. In this regard, it has been reported that this biological agent seems to induce clinical improvement and diminution of the abnormalities found in B lymphocytes in patients with this condition. In addition, we have previously found that the addition of Rituximab to the immunosuppressive therapy of patients with refractory lupus nephritis resulted in a marked improvement in both, renal function and disease activity. Furthermore, it has been reported that Rituximab therapy of SLE patients is associated with diminution of activation markers of T lymphocytes, including the expression of CD40L, as well as with a significant effect on the levels and function of T regulatory cells, and the induction of T cell apoptosis.  

In an open clinical trial we have explored the possible therapeutic effect of Rituximab in SLE patients with severe manifestations, specifically with severe nephritis or CNS affection or massive pulmonary hemorrhage. Our data strongly suggest that Rituximab exerts an important beneficial effect in most of these patients. In our previous report we emphasize that patients with severe nephritis (type IV: 18, type III and type V: 2) had improvement of levels and function of T regulatory cells and induction of T cell apoptosis, immunological facts which could explain the clinical response to diverse dosages of rituximab in spite do not have increased steroids therapy or do not have used steroids. In this paper we show our clinical data of this group of patients, besides two additional groups, one of them with very serious neurological affection and the other one, three patients with massive pulmonary hemorrhage.  

### Patients and methods  

Thirty-one SLE patients with severe disease, and in most of them refractory to conventional intensive treatment were enrolled in a preliminary open and prospective clinical trial. Patients had severe lupus manifestations, twenty-two with lupus nephritis, six with neuropsychiatry manifestations, and three with massive pulmonary hemorrhage. All patients fulfilled the classification criteria of the American College of Rheumatology for the diagnosis of SLE, and disease activity was scored according to the MEX-SLEDAI index. Most of our patients with lupus nephritis had WHO type IV (18), and less frequent were type II (2) and V (2); all of them under DMARD's therapy and most with variable doses of steroids, with persistent activity, through proteinuria, urinary red or white cells or casts. Following was made with creatinine levels, diary proteinuria and creatinine clearance. Patients received Rituximab 500 to 1000 mg once or twice, at 2 week intervals, and the therapeutic response was evaluated by clinical and laboratory parameters. The rituximab dosage varied because economic limitation; previously we have used low dosage of rituximab in diverse autoimmune diseases (rheumatoid arthritis, dermatomyositis, and systemic lupus erythematosus) with similar results (B cell depletion, immune-regulatory effects, and clinical response) of those reported with conventional approved doses. All patients were pretreated with dexametasone (8 mg i.v.) or prednisone, (40 mg., p.o.), and loratadine (10 mg p.o.). Infusion of Rituximab started slowly (15 drops/min), increasing each 20 min. Because patients with renal involvement were under immunosuppressive therapy (most of them with 2 or more DMARD's) when occurred their renal exacerbation or relapse, we decided that did not necessary to increase steroid dosage and maintain without this drug in 6 of them. We included here, two other patient groups, one with severe central neurologic involvement and the other one with acute massive pulmonary hemorrhage, and all of these patients received high doses of methylprednisolone together. Massive pulmonary hemorrhage was defined characteristically with severe acute respiratory failure with diminution of 3 or more grams of haemoglobin without any other potential responsible causes; so, three patients with massive pulmonary hemorrhage diagnosis were treated with 1 g of rituximab, and additionally received methylprednisolone (at least 1 g/day for 4 days), cyclophosphamide (500 mg/m²), and azathioprine (150 mg/day) or methotrexate (15 mg), beside diary hemodialysis. When data of an allergic reaction were detected, infusion was stopped, and hydrocortisone was administered (100 mg i.v.). In these cases, after a careful clinical evaluation, Rituximab infusion was re-started, upon the continuous monitoring of these patients.  

To evaluate differences from basal and 60 days post-rituximab therapy, we used descriptive statistical analysis and comparison media values with t student.

### Results  

We have previously reported that the addition of Rituximab to the immunosuppressive therapy of patients with refractory lupus nephritis is associated with significant improvement in different clinical and laboratory parameters. All, except two of them had B cell depletion with 500 to 2 g of rituximab. All patients were under intensive immune-regulatory therapy and we decided that in spite renal activity the dose of glucocorticoids remained unchanged during the study, and in six cases whose did not are with steroid therapy, these drugs were not administered, but the patients continued with their DMARD's therapy.  

In the Table 1, we show the demographic characteristics of our patients with SLE and severe glomerulonephritis. As previously reported in these patients, Rituximab therapy induced a significant improvement in different clinical parameters in most of them, in spite the administration of only 10.0 g of this biologic agent. It is worth mentioning that in six of these patients, no glucocorticoids additionally to those associated to rituximab infusion were administered and that in the rest of the group the dose of these anti-inflammatory drugs remained unchanged. In these patients with severe glomerulonephritis, the disease activity (MEX-SLEDAI index) significantly diminished (p<0.05) as well as proteinuria, in most of them (from 3.710 g/L to 1.786 g/L, p<0.05). Diminution of proteinuria occurred as early as at day 8 after the
first infusion of Rituximab. Creatinine clearance increased in 72% of patients, but this variation did not reach statistical significance (73 to 86 ml/1.73 m²), neither the apparent diminution of serum creatinine levels (0.97 to 0.78 mg/dl).

Five of our patients showed a complete remission of renal disease (defined as normal renal function, inactive sediment and proteinuria < 500 mg/L), and seven patients showed a partial renal response (stable renal function, inactive sediment and diminution of proteinuria > 50%). Six additional patients exhibited improvement in one or several renal parameters, however diminution of proteinuria was observed in one or several renal parameters, however the other two patients did not show improvement of any renal response (stable renal function, inactive sediment and proteinuria).

As we mentioned previously, most of patients with severe glomerulonephritis (20/22) that received Rituximab had evidence of B cell depletion and only one of them had a severe and fatal pulmonary hemorrhage and renal disease was admitted to the emergency room. Schönlein-Henoch syndrome diagnosis was established, and prednisone 0.5 mg/kg/day improved his clinical manifestations. However, a renal biopsy showed diffuse and generalized glomerulonephritis, with crescents in 15% and immune granular deposits. An aggressive immunosuppressive therapy was started with prednisone 20 mg/kg/day, cyclophosphamide, azathioprine and cyclosporine, but no favorable response was observed with an enhanced proteinuria (1.25 g/L), heavy erythrocyturia, numerous casts, and a significant diminution in creatinine clearance (60 ml/min). Rituximab

### Table 1

Demographic characteristics of SLE patients included in the study

<table>
<thead>
<tr>
<th>Age/ gender</th>
<th>Time of evolution</th>
<th>Clinical manifestations</th>
<th>Nephritis type/duration (years)</th>
<th>Disease activity*</th>
<th>Previous therapy</th>
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<tr>
<td>41/F</td>
<td>15</td>
<td>OU, Ar, Le, Ly</td>
<td>IV/8</td>
<td>12</td>
<td>GC, Cyc, Aza</td>
</tr>
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<td>24/M</td>
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<td>Er, Ph, Le</td>
<td>IV/4</td>
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</tr>
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<td>32/F</td>
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<tr>
<td>43/F</td>
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<tr>
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<td>IV/1</td>
<td>10</td>
<td>GC, Mtx, Aza, MmF, Cq</td>
</tr>
</tbody>
</table>

Ar: arthritis; Aza: azathioprine; CNS: central nervous system; Cq: chloroquine; Cyc: ciclosporine; Er: erythema; GC: glucocorticoids; Le: leukopenia; Lfm: leflunomide; Ly: lymphopenia; MmF: mycophenolate; Mtx: methotrexate; N: nephritis; OU: oral ulcers; Ph: photosensitivity; Se: serositis; SLE: systemic lupus erythematous.

* MEX-SLEDAI index.

Clinical examples

1. A nine years old boy, with asymmetric oligoartthritis, a papular skin rash, abdominal pain, and evidence of renal disease was admitted to the emergency room. Schönlein-Henoch syndrome diagnosis was established, and prednisone 0.5 mg/kg/day improved his clinical manifestations. However, a renal biopsy showed diffuse and generalized glomerulonephritis, with crescents in 3/15 glomerulus, and immune granular deposits of IgG, IgA, IgM, C3 and C1q. An aggressive immunosuppressive therapy was started with prednisone 1.0 mg/kg/day, cyclophosphamide, azathioprine and cyclosporine, but no favorable response was observed with an enhanced proteinuria (1.25 g/L), heavy erythrocyturia, numerous casts, and a significant diminution in creatinine clearance (60 ml/min). Rituximab
(0.5 g, two infusions, at days 1 and 15) was added to his therapy and a significant improvement in most clinical (asymptomatic) and laboratory (proteinuria of 425 mg/L, creatinina clearance of 85 ml/min) parameters was observed. However, an active urinary sediment persists 18 months after Rituximab therapy, and actually his therapy is with mycophenolate, low doses of steroids, methotrexate, statins, angiotensin inhibitors and vitamin D. The interest to report this patient is because Schönlein-Henoch purpura is a rare SLE presentation, but in spite adequate therapy persist with glomerulonephritis activity.

2. A 21 years old female with diagnosis of SLE, and under cytotoxic therapy because type IV lupus nephritis was admitted because photosensitivity, facial erythema, polyarthralgias, myalgias, transitory pleuritic chest pain, and fever, with an active urinary sediment and 3.25 g/L of proteinuria. One week later of rituximab therapy, proteinuria fall to 1.75 g/L, and no casts or erythrocytes were detected in a new urine
Our findings further support the previous reports on the beneficial effect of Rituximab administration in patients with SLE, mainly in patients with severe and refractory nephropathy as well as those with CNS disease.23,34–36 However, this biological agent does not seem to have a role in the therapy of the massive pulmonary hemorrhage associated to SLE, at least for the treatment of the acute, severe manifestations of this condition, potentially fatal in a few days, episodes of short time that may be do not permit the action of immune therapy including rituximab.

Most of our patients with severe lupus nephropathy had a dramatic improvement after Rituximab administration. However, two patients showed progression to renal failure, one of them died and the other one is in hemodialysis. One of these patients had serious mixed acidosis conditioned by uncontrolled diabetes mellitus and an undetected infectious process. At necropsy, two fungal infections were detected, histoplasmosis in the lungs, and mucormycosis in a coronary artery. However, according to our study, Rituximab, although a potent inducer of B cell depletion, and show a strong anti-inflammatory/immunosuppressive effect, its administration seems to be rarely associated to serious adverse events, even when is combined with different immunosuppressive drugs. In addition, Rituximab seems to maintain its therapeutic effect for months or even years, as we describe here, and it has been reported by others, but frequently because relapses in the cases of severe lupus nephritis we should consider a new course of this B cell depletory therapy.23–30,37

We consider that it would be of interest to assess the efficacy of Rituximab as a single immunosuppressive agent for the therapy of severe SLE. We think that it is possible that, at least in some cases, Rituximab alone would be able to exert a significant beneficial effect, and even, in some patients, to induce disease remission. In this regard, it is worth mentioning that in six patients of our study, the beneficial effect of Rituximab was exerted without the concomitant administration of glucocorticoids. In this regard, these data suggest that glucocorticoids could be not as important in Rituximab therapy of autoimmune diseases as previously thought, in particular when patients are being treated with immune-regulatory agents, and additionally if we do not increase or prescribe steroids, we will have less immunosuppressive effects associated to this therapy, but with similar efficacy. Finally, it is important to keep in mind that we performed an open preliminary trial and that our results on the apparent beneficial effect of Rituximab in severe SLE should be validated through a large controlled and blinded study.

References


