Matters arising

How should we manage fibromyalgia?

We read with interest your leader, “How should we manage fibromyalgia?”1 We were puzzled by Paul Reilly’s statement that a comprehensive pain management programme has the best chances of success, although even rheumatologists can practise amateur cognitive behavioural therapy in the clinic.2 Is Dr Reilly really suggesting that a rheumatologist’s amateur efforts offer the best outcome for people with fibromyalgia? Dr Reilly offers no evidence to support this statement. He does, however, find evidence to raise questions as to the value of patient self help groups. Dr Reilly cites a 1992 paper that reports an association between membership of such a group and worse prognosis in chronic fatigue syndrome.3 As the authors emphasised the caution with which the results should be interpreted, it is surprising that Dr Reilly has used this evidence to inform his clinical practice.

Firstly, this is ancient research. Things have moved on. Although we would agree that some so called self help groups can end up as a circular review of symptoms, self management courses, which we at Arthritis Care espouse, are a very different matter. Challenging Arthritis is a self management programme— and that title was chosen very deliberately. It is run by people with arthritis for people with arthritis. It gives people the skills to take control of their lives and their arthritis. It is practical and positive, and it works. The effectiveness of similar programmes in the USA is well recorded.4

Experience in the United Kingdom shows similar results, including better understanding of symptoms, improved communication with medical staff, and increased use of exercise and relaxation techniques. Probably most importantly of all, self management programmes significantly decrease pain, fatigue, and anxiety.5

So it is extremely important to differentiate between navel gazing self help systems and courses such as ours, which encourage people to take control for themselves—and which work.

Similar courses run on the Challenging Arthritis model are now available to people with other chronic conditions.

Given Dr Reilly’s desire to disabuse patients of the notion that their fibromyalgia is his problem alone, shouldn’t his effective courses encourage people to take control for themselves be a welcome adjunct to his treatment, even if it is run by a patient self management group?

Author’s reply

I am surprised that Ms Lloyd has chosen to be rather negative about an editorial that was designed to combine optimism with realism. Although one might be optimistic that every patient with fibromyalgia, and similar functional pain syndromes, might have access to professional psychological advice and management, reality dictates that this is not the case, at least not within the health service as it operates in the United Kingdom. As cognitive behaviour therapy sets out to influence the manner in which patients with fibromyalgia think and behave in an attempt to decrease the impact of their disorder, I have merely pointed out that an interested rheumatologist can employ communication and motivational skills, which in many cases will serve the same purpose as formal psychological management.

Ms Lloyd makes much of the “Challenging Arthritis” self management programme run by Arthritis Care. Fibromyalgia, of course, is not a form of arthritis but a form of non-articular rheumatism. I have little doubt that an appropriately run education programme can help people with fibromyalgia cope more effectively with their symptoms. However, self help groups often work to a different agenda than treating clinicians. They function as a lobby to increase recognition and acceptance of a particular disorder, and sometimes such a campaign has financial rewards through litigation and compensation. Not only the objectives but also the objectivity of such a group can be called into question. However, I am delighted to learn from Ms Lloyd that the “Challenging Arthritis” programme is so good and so effective.

Finally, to accuse a paper published in 1992 of being “ancient research” is not only insulting to the authors but also inaccurate. High quality research has a longer shelf life than eight years.

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Letters

A “missed” cryoglobulin: the importance of in vitro calcium concentration

Cryoglobulins are immunoglobulins which precipitate at reduced temperature and that re dissolve by warming the serum sample to 37 °C. Mixed cryoglobulinaemia may manifest clinically as skin, articular, renal, and peripheral nerve complications.1 To ensure optimal detection, serum samples must be obtained and preserved at 37 °C. We report on a patient whose clinical presentation was suggestive of cryoglobulinaemia. Because cryoglobulins had been either undetectable or found at very low levels several years despite repeated careful blood sample examinations with conventional assays, we initially thought he had Henoch-Schönlein purpura. The recent use of a modified assay finally led us to diagnose mixed cryoglobulinaemia. Included below is a description of the method used for cryoglobulin detection, emphasising the importance of in vitro calcium concentration.

Case report

A 52 year old man with multiple lipoma had a 20 year history of polyarthralgias affecting elbows, wrists, hands, knees, and feet, a 10 year history of Raynaud’s disease affecting the hands and feet, and a seven year history of palper purpura. He had a coeliac disease. In June 1996 he developed attacks of abdominal pain concomitantly with arthralgias and palper purpura of both legs. Serum creatinine was 95 µmol/l. Gamma globulins were low (4.2 g/l) on serum protein electrophoresis. Serum concentrations of immunoglobulins were 4.49 g/l for IgG (normal range 6.42–11.92), 1.84 g/l for IgM (normal range 0.52–1.47), and 2.51 for IgA (normal range 0.10–0.40). Behringer Dade, Deerfield, USA) and for CH50 (home method) 25% of the normal range (60–120%). C3c and C3PA were also decreased at respectively 0.34 g/l (normal range 0.60–1.10) and <0.04 g/l (normal range 0.10–0.40). A complete set of sero markers was negative for hepatitis B and C viruses. Cryoglobulin measurements were initially negative or inconclusive (table 1). Proteinuria was negative. Radiographs of the affected joints were normal. A computed tomographic scan of the abdomen showed a thickened aspect of the duodenal and jejunal loop wall. Skin biopsy was not performed. Prednisone treatment (30 mg/day) was started but, owing to poor response, plasmapheresis was carried out in March 1997; azathioprine (150 mg/day) and colchicine (2 mg/day) were then added and, finally, a marked clinical improvement was obtained. A new flare up occurred in August 1999. Prednisone pulses followed by high dose methylprednisolone pulses followed by high dose methylprednisolone and a serum creatinine at 192 µmol/l in July 1999. A new evaluation was made. A bone marrow biopsy was normal. The skin biopsy showed leukocytoclastic vasculitis with slight

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Table 1  Evolution of cryoglobulinaemia, rheumatoid factor, and complement levels

<table>
<thead>
<tr>
<th>Date</th>
<th>Cryoglobulinaemia (µg/ml)</th>
<th>Type</th>
<th>Rheumatoid factor (Rose-Waaler test)</th>
<th>C4 (g/l)</th>
<th>CH50 (%)</th>
</tr>
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<tr>
<td>January 1994</td>
<td>29</td>
<td>Oligoclonal IgM</td>
<td>0</td>
<td>&lt;0.06</td>
<td></td>
</tr>
<tr>
<td>June 1996</td>
<td>25</td>
<td>Oligoclonal IgM</td>
<td>1 / 128</td>
<td>&lt;0.06</td>
<td></td>
</tr>
<tr>
<td>August 1996</td>
<td>17</td>
<td>Oligoclonal IgM</td>
<td>ND</td>
<td>&lt;0.06</td>
<td></td>
</tr>
<tr>
<td>December 1996</td>
<td>188</td>
<td>III, polyclonal IgG, IgA, and IgM</td>
<td>ND</td>
<td>&lt;0.07</td>
<td></td>
</tr>
<tr>
<td>March 1997</td>
<td>4</td>
<td></td>
<td>1 / 128</td>
<td>&lt;0.07</td>
<td>&lt;20</td>
</tr>
<tr>
<td>October 1998</td>
<td>63</td>
<td>III, polyclonal IgG, IgA, and IgM</td>
<td>ND</td>
<td>&lt;0.07</td>
<td></td>
</tr>
<tr>
<td>November 1998</td>
<td>110†</td>
<td>II, IgM + polyclonal IgG, IgA, and IgM</td>
<td>ND</td>
<td>ND</td>
<td></td>
</tr>
<tr>
<td>December 1998</td>
<td>166†</td>
<td>II, IgM + polyclonal IgG, IgA, and IgM</td>
<td>ND</td>
<td>ND</td>
<td></td>
</tr>
<tr>
<td>January 1999</td>
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<td>February 1999</td>
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</tr>
<tr>
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<td>0.30</td>
<td></td>
</tr>
<tr>
<td>May 1999</td>
<td>848†</td>
<td>II, IgM + polyclonal IgG, IgA, and IgM</td>
<td>ND</td>
<td>ND</td>
<td></td>
</tr>
</tbody>
</table>

*Normal <15 µg/ml.
†Determination performed using the method described above since November 1998.
‡Normal range 60–120%.

Fig. 1 Western blot of cryoglobulin. Pattern obtained with anti IgG, IgA, IgM, κ and λ chain labelled with alkaline phosphatase on cryoglobulins transferred onto nitrocellulose sheets: oligoclonal (top) and polyclonal pattern (middle) for cryoglobulin washed with conventional assay, type II pattern IgMx (arrow) and polyclonal IgG, IgA, and IgM for cryoglobulin washed with current assay (bottom).

deposits of IgM, IgA, and C3 on immunofluorescence study. Renal biopsy showed an endocapillary and extracapillary glomerulonephritis with glomerular crescents in a mean of 30% of glomeruli, and IgG, IgM, and C3 deposits on immunofluorescence study. Prednisone was continued and cyclophosphamide was given orally (150 mg/day). The patient’s condition is stabilised at the present time.

A modified assay was developed to detect a possible cryoglobulin. Briefly, a serum sample was obtained and centrifuged at 37°C, then stored at 4°C for eight days. The precipitate was separated by centrifugation, then washed each day for three consecutive days with either cold phosphate buffered saline (PBS; conventional assay) or distilled water to enhance the protein solubility (current assay). Indeed, we noted that some of the precipitate was lost in the PBS. Then, each precipitate was dissolved in a low volume of PBS for measurement of protein (Hartree assay adapted for cryoglobulins) and typed by Western blot (Fig. 1). Precipitates obtained by both methods were analysed with two dimensional polyacrylamide gel electrophoresis. In addition, some cryoprecipitate samples were passed at 37°C over protein G-Sepharose columns. Proteins were then eluted using HCl-glycine, pH 2, and analysed with two dimensional polyacrylamide gel electrophoresis.

The influence of calcium concentration on cryoglobulin solubility was investigated as follows. Solubility of the cryoglobulin obtained with distilled water was tested by adding Hanks’s solution containing either Ca²⁺ (1.26 mM) and Mg²⁺ (0.80 mM), Ca²⁺ (1.26 mM) without Mg²⁺, or Mg²⁺ (0.80 mM) without Ca²⁺. The dissolved proteins were measured as described above. About 50% of the precipitate became soluble when Ca²⁺ was present in the milieu, contrasting with 5% solubility only when Ca²⁺ was absent.

Our observation indicates that cryoglobulin-emia must remain highly suspected despite apparently negative laboratory results when clinical and biological data—namely, low C4 associated with positive rheumatoid factors—are consistent with, or even more suggestive of this diagnosis. Indeed, monoclonal or polyclonal rheumatoid factors are nearly always part of mixed cryoglobulins, where they bind to immune complexes—principally antigen complexed IgG—that subsequently precipitate. Nevertheless, when using conventional assay, cryoglobulin remained negative or weakly positive in our patient. Interestingly, a monoclonal IgMx was sometimes found on immunofixation analysis. In November 1998, the occurrence of glomerulonephritis consistent with cryoglobulin related kidney complications prompted us to perform further tests for cryoglobulins, including the method described above. Then, a high titre type II cryoglobulin (>1000 µg/ml) was isolated, and subsequently shown to consist of monoclonal IgMx and polyclonal IgG, the former being thought to support the previously detected rheumatoid factor activity. Two dimensional polyacrylamide gel electrophoresis confirmed the presence of polyclonal IgG and monoclonal IgM in the cryoprecipitate, and allowed identification of an additional monoclonal IgM. Finally, electrophoretic studies of the proteins eluted from protein G columns showed the presence of polyclonal IgG, with only traces of the monoclonal IgMx, indicating that the complex dissociated at 37°C.

This cryoglobulin has unusual properties because it became soluble in PBS, while it precipitated in serum, distilled water, or calcium buffers. Usually, cryoprecipitation is a two step process. Firstly, rheumatoid factors bind to immune complexes at reduced temperature because of a cold enhanced affinity. Secondly, the large immune complexes precipitate. This requires favourable physicochemical conditions, including suitable pH and ionic strength of the solvent. Usually, the precipitate is stable in saline. Our data suggest that calcium concentration may be crucial for cryoglobulin precipitation, as in the case reported by Qi et al. This property might account for some of the discrepancies observed between the conventional and the current assay. It might also explain the severity of the symptoms in vivo. Further investigation is needed to approach the other determinants of precipitation. Hypocryoglobulins display a quite different property in the way they are isolated from hypotonic serum, though they lead to the same clinical syndrome.
Computed digital absorptiometry of the hand: screening method of bone loss in postmenopausal women with RA

Dual energy x ray absorptiometry (DXA) is the most commonly used method of measuring bone mineral density (BMD) but it has been shown to be a good predictor of the future risk of fracture. Unfortunately, the generalised use of DXA is limited as it is expensive and time consuming, is not portable, and is available only in large centres. Computed digital absorptiometry (CDA) of the hand is a new bone densitometry technique, designed to assess the BMD of the middle phalanx of the third finger using a direct, automated measurement of x ray attenuation. This technique is similar to radiographic absorptiometry but provides immediate results; in current radiographic absorptiometry, radiographs are sent to an off site processing centre and the results are received a few days later. CDA is cheap and quick. Its precision and accuracy seem to be acceptable, but it’s ability to discriminate between patients with osteoporosis and normal subjects, to predict the risk of future fracture, and to monitor the response to therapeutic intervention has not been established.

Rheumatoid arthritis (RA) is a risk factor for osteoporosis. The available data suggest that there is an increased risk of hip fracture in patients with RA, especially when they are treated with glucocorticoids. DXA is the preferred technique for assessing the presence of bone loss in these patients. However, the prevalence of RA in the general population is high, and it is, therefore necessary to use DXA to investigate only those patients at high risk of osteoporosis. Criteria to decide who should be evaluated are currently not available.

We have undertaken a study to evaluate whether CDA might be a useful screening technique for identifying the patients with RA who should be examined by DXA. Over a period of three months all postmenopausal women with RA, evaluated in the rheumatology outpatient clinic, who fulfilled the inclusion criteria were (1) duration of RA longer than one year, (2) treatment of postmenopausal period longer than one year, and (3) no current treatment with bone thinning agents.

Forty five patients fulfilled the inclusion criteria and consent and were obtained from 40 of these. In these patients BMD was assessed by DXA and CDA on the same day. One further patient was not included in the study as she had a severe ulnar deviation that did not allow CDA to be used.

For DXA, BMD (g/cm²) of the lumbar spine and upper femur was assessed using a dual energy x ray system (Hologic QDR 1000, Hologic Inc, Waltham, Mass); we considered the mean value of the 2 measurements and the value of the femoral neck. For CDA, BMD (g/cm²) of the middle phalanx of the third finger of the non-dominant hand was assessed using a dual energy x ray system (AccuDEXA, Schick Technologies, Long Island, NY). The x ray attenuation data was automatically processed and represented as a grey scale image. To assess the in vivo short term precision, 10 serial measurements (with interim repositioning) were performed in seven healthy volunteers. The in vivo precision of AccuDEXA, expressed as a coefficient of variation, was 1.16% (0.74 to 1.56). Data were cross referenced with the T score. According to WHO criteria, osteoporosis is defined as a T score below -2.5.

A Spearman correlation test and linear regression analysis were used to test the relation between the variables; p<0.05 was considered significant. A 2x2 table was used to evaluate the positive and negative predictive value of CDA for the diagnosis of osteoporosis established by DXA.

Table 1 lists the clinical characteristics of the patients and the mean BMD values obtained.

BMD at the lumbar spine (g/cm²) 0.840 (0.150)
BMD at the femoral neck (g/cm²) 0.560 (0.110)

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Table 1 Clinical characteristics of the patients with RA and BMD values obtained (n=39). Values are expressed as mean (SD)

| Age (y) | 61.2 (8.3) |
| Duration of postmenopausal period (y) | 13.3 (7.5) |
| Duration of rheumatoid arthritis (y) | 9.7 (6.4) |
| Rheumatoid factor positive (n) | 32 |
| Erosive RA (n) | 16 |
| Treatment with low dose glucocorticoids (n) | 32 |
| BMD at the lumbar spine (g/cm²) | 0.840 (0.150) |
| BMD at the femoral neck (g/cm²) | 0.560 (0.110) |
| BMD at the middle phalanx of the third finger (g/cm²) | 0.390 (0.090) |

* BMD = bone mineral density.
Rubella infection in adult onset Still’s disease

The aetiology of adult onset Still’s disease remains unknown although some authors have tried to relate it to a viral infection. We describe here a case of typical adult onset Still’s disease with a seroconversion in the rubella IgG antibody titre to emphasise once more that it is probably more than a coincidental event. A 26 year old woman was admitted because of fever with chills, a pruritic rash, myalgia, sore throat and headache. At the time of examination the temperature was 40°C and the pulse rate 104 beat/min. The rash consisted of small pruritic macules over back, periorbicular, legs and arms. The patient was rhythmless. Some small cervical lymphadenopathies were detected. The leucocyte count was 42.3 × 10^3 cells/l (93.2% neutrophils) and the haemoglobin concentration was 79 g/l. Liver enzymes were slightly increased and lactate dehydrogenase was 17.33 µkat/l. The serum albumin concentration was 26 g/l and the erythrocyte sedimentation rate 60 mm 1st. The serum ferritin was higher than 1500 µg/l (normal value: 20–250 µg/l). Roentgenogram of chest and bone analysis were normal as well as blood and urine cultures. Abdominal computed tomography showed hepato-splenomegaly. An electromyographic study was normal. Tests for antinuclear antibodies and rheumatoid factor were negative. Serum concentrations of immunoglobulins and complement were normal. Serological tests for hepatitis A, B or C, cytomegalovirus, parvovirus B19, human immunodeficiency virus 1 and 2, Epstein-Barr virus, Mycoplasma, Treponema pallidum, Borrelia burgdorferi, Toxoplasma, Salmonella, Brucella, Le- gionella, Coxiella burnetti, Chlamydia and Rickettsia were negative. Serum rubella IgG antibody titre was 140 000 IU/l.

In our case we think that rubella was more probably attributable to a reinfection than to a primary infection because the patient had been correctly vaccinated in childhood and this is also supported by the increase in IgG antibody titre without increase in IgM concentration. This seroconversion is not explained by a non-specific polyclonal stimulation after a generalised inflammatory disease because there was no increase in other measured antibody titres.

Although aetiology of adult onset Still’s disease is unknown, some authors have tried to demonstrate that infective agents, especially viruses, can be the trigger of the illness in susceptible patients. Adenovirus, echovirus 7, mumps, cytomegalovirus, para-influenza, Epstein-Barr virus, influenza A, parvovirus B19, hepatitis B or C and rubella have been associated. The relation between rubella virus and adult onset Still’s disease has been reported in some series and case reports since the initial description by Bywaters in 1971.

Wouters et al performed exhaustive virological studies in five patients with adult onset Still’s disease in an early phase of the illness and found evidence of viral infection in three cases, two of them corresponding to rubella. The rubella virus genome has also been detected in peripheral blood cell population from patients with adult onset Still’s disease.

In summary, we think that the increased rubella IgG antibody titre in our patient should not be considered an anecdotal event and probably rubella virus has been the trigger of the illness. Our case, together with previously published reports, supports the hypothesis about the role of viruses in the aetopathogenesis of adult onset Still’s disease.

Brain atrophy from alveolar macrophages.
pulmonary artery of these three patients were measured by catheterisation. The pressures of systolic pressure was higher than 25 mm Hg in the three patients with SSc whose right ventricular systolic pressure was 16.4 and 14.7 mg/Hg, respectively. The duration of disease was two to seven years. The pulmonary artery pressures of patients 4, 5, and 6 were 46, 59, and 60 mmHg, respectively. The levels of adrenomedullin in the plasma of patients 4, 5, and 6 were 24.9, 58.1, and 27.5 pg/ml. These results, however, did not reach statistical significance as the number of patients was small.

Patients 4, 5, and 6 were taking the following drugs: nifedipine, nicardipine hydrochloride (patient 1), nifedipine and triclopidine hydrochloride (patient 2), and nicardipine hydrochloride and methylprednisolone (patient 3).

For the comparison group we selected patients with diffuse-type SSC without PH, as all of three patients with SSC with PH had diffuse-type SSC. Six normal volunteers (three women and three men, age 29–40) were also studied. Concentrations of adrenomedullin were measured by radioimmunoassay. Statistical significance was analysed with the Mann-Whitney U test.

Concentrations of adrenomedullin in the plasma were significantly higher in patients with SSC with PH than in those with SSC without PH (p = 0.011) or than in normal volunteers (p = 0.020) (fig 1A). The concentrations of adrenomedullin or endothelin-1 in the plasma from a patient with primary PH were similar to those from patients with SSC without PH (data not shown). The levels of endothelin-1 in patients with SSC with PH were raised compared with those in patients with SSC without PH (p = 0.041) (fig 1B). We did not measure levels of endothelin-1 in normal volunteers (fig 1B).

We recently obtained similar results when measuring the levels of the mature form of adrenomedullin and total adrenomedullin in a different group of patients with SSC with (patients 4, 5, and 6) or without PH, by immunoradiometric assay. The three patients with SSC with PH were women aged 43–54, and two patients with SSC without PH were women aged 47 and 55. The duration of disease was two to seven years. The pulmonary artery pressures of patients 4, 5, and 6 were 46, 59, and 60 mmHg, respectively. The levels of adrenomedullin in the plasma of patients 4, 5, and 6 were 24.9, 58.1, and 27.5 pg/ml. These results, however, did not reach statistical significance as the number of patients was small.

Patients 4, 5, and 6 were taking the following drugs: nifedipine, nicardipine hydrochloride, and beraprost sodium (patient 4); nifedipine and triclopidine hydrochloride (patient 5); and nifedipine (patient 6). Levels of adrenomedullin in the plasma of patients with SSC with PH were higher in patients with SSC with PH than in healthy volunteers (p=0.011).

Our results suggest that the amount of adrenomedullin is insufficient to inhibit either the spasm of pulmonary vessels or the proliferation of endothelial cells of the vessels, though the levels of adrenomedullin in plasma increased enough to antagonise the effects of endothelin-1 in patients with SSC. It has been recently reported that chronic infusion of adrenomedullin reduces PH and right ventricular hypertrophy in rats. Thus our results also suggest the possibility that interventions aimed at controlling the balance of adrenomedullin and endothelin-1 might prove fruitful in preventing PH in patients with SSC.

Avascular necrosis of a single vertebral body, an atypical site of disease in a patient with SLE and secondary APLS

Antiphospholipid syndrome (APLS) is characterised by recurrent arterial or venous thrombosis. Deep veins, such as the femoral and popliteal veins are by far the commonest sites of thrombosis. The arterial and venous systems of the mesenteries, liver, kidneys and the adrenal glands are also involved. We report here a 39 year old woman with systemic lupus erythematosus (SLE) and secondary APLS who presented with subacute onset of back pain and was found to have avascular necrosis (AVN) of a single vertebral body at L2, an atypical presentation of this complication.

In 1976, a 17 year old white woman complained of gastrointestinal upset and frequent joint pain in her hands and knees a few months after she started taking oral contraceptives. She was found to have Coombs’ positive haemolytic anaemia, leucopenia, thrombocytopenia and deranged liver function. Serologically, she had positive anti-nuclear antibody (ANA, 1/1280 on rat liver cells), anti-double stranded (ds) DNA antibodies (1/320 on Crithidia luciliae) and posi-


In summary, this patient suffered from SLE with secondary APLS who had been managed with low dose corticosteroids for more than 20 years was complicated by the development of AVN at an atypical site.

This case highlights two interesting points. The first is the atypical presentation of the development of AVN at an atypical site. The second is the atypical presentation of the AVN involving an isolated L2 vertebral body. The atypical presentation of the AVN involving an isolated L2 vertebral body is of interest. The AVN involving an isolated L2 vertebral body has been reported in patients with APLS and Pick-up by bone scan as multiple hot spots. The lunate bone is another unusual site of involvement by AVN. Kienbock's disease (AVN of lunate bone) was reported in a patient with primary APLS and two others with antiphospholipid (APL) antibodies but without other clinical features that satisfied the diagnosis of APLS.

Immunoglobulin and lymphocyte decrease concurrent with adverse reactions induced by methotrexate for RA

The limiting factor in low dose pulse methotrexate treatment for rheumatoid arthritis (RA) has been its toxicity.4 We recently treated a female patient with RA, in whom pneumonitis and granulocytopenia developed during methotrexate treatment; her white blood cell count was 1.10 × 10^9/l and Pao_2 was 37 mm Hg. Before treatment, at the time of development of adverse reactions, and after recovery after methotrexate was withdrawn, her IgG levels were 17.99, 10.15, 16.75 g/l, IgA 5.14, 3.69, 4.33 g/l; IgM 1.73, 1.06, 0.36 g/l; and albumin 3.90, 4.10, 4.02, 1.56 × 10^9/l, respectively. We then investigated whether immunoglobulin levels and lymphocyte count decrease when adverse reactions to methotrexate develop. One hundred consecutive patients with RA (80 women and 20 men, mean (SD) age 57.5 (9.2) years) receiving between 2.5 and 15 mg of methotrexate weekly in Tokyo Metropolitan Komagome Hospital were followed up from 1991 to 1998. When the patients did not respond and had no adverse reactions, the dose was increased by 1.25 to 2.5 mg/week. Response to treatment, assessed by the patient's impression of improvement, a decrease in swelling and pain of more than two joints, a decrease of >20 mg/l in the C reactive protein (CRP) level, adverse reactions, lymphocyte and eosinophil counts, serum concentrations of immunoglobulins, fraction, rheumatoid factor, and albumin were studied.

Sixteen adverse reactions occurred in 15 patients; the reactions affected the liver (six patients), the lung (three), the skin (three), the bone marrow (three), and the oral mucosa (one). They recovered after methotrexate was discontinued or reduced, without steroid treatment. Thirteen of these 15 patients showed a mean (SD) decrease in
Comparison of patients with and without adverse reactions.

Normal range for IgG is 8.71–20.7 g/l, IgA 0.12–5.80 g/l, and IgM 0.53–2.98 g/l.

NS = p<0.05; *p<0.05; ***p<0.005; ****p<0.0001.

†To differentiate between patients with and without adverse reactions.

CRP from 63 (36) to 32 (55) mg/l, whereas all 22 non-responders who had no adverse events showed a decrease in CRP from 46 (39) to 41 (34) mg/l. A significant relation was found between a good response to treatment and the appearance of adverse reactions. The patients with adverse reactions had a higher creatinine level, and more frequent use of steroid at high dose (7.9 (7.8) mg/day prednisolone). The patients with adverse reactions had been given for a long time without a significant change in the dose.

Our study shows that when a patient's immunoglobulin levels and lymphocyte count decrease globally by as much as 25% or more from the pretreatment level, this decrease is suggestive of toxicity. Conversely, in patients without adverse reactions, the decreases were less than 20%. The clinical improvement contributed only partially to the reductions; steroid treatment was not likely to have been the cause either, as they had been given for a long time without a significant change in the dose.

Recently, we reported that the immunoglobulin level decreases with adverse reactions, during a disease modifying anti-rheumatic drug, bucillamine, treatment. A reduction in interleukin 6 level was reported to parallel an improvement during methotrexate treatment. The reduction in lymphocyte numbers is controversial. Immuno-modulation might relate mainly to adverse reactions, whereas the effect might appear owing to anti-inflammatory mechanisms. It can only be speculated whether consumption or leakage of immunoglobulin plays a part in the previously supposed mechanism of acute hypersensitivity or cytotoxicity, or in an independent episodic phenomenon. There is the encouraging possibility that monitoring the immunoglobulin level and the lymphocyte count might disclose life threatening reactions and enable the doctor to know when to reduce the dosage or to stop the drug entirely.

The authors thank Dr Victoria Elegant and Ms Keiko Miyahara for their help.

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<table>
<thead>
<tr>
<th>IgG</th>
<th>With adverse reaction</th>
<th>Without adverse reaction</th>
<th>p Value</th>
<th>Threshold value</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>20.87 (7.34)</td>
<td>20.12 (5.50)</td>
<td>NS</td>
<td>4.62</td>
<td>***</td>
</tr>
<tr>
<td>Post–pre (g/l)</td>
<td>−6.23 (5.53)</td>
<td>−1.47 (3.73)</td>
<td>****</td>
<td>0.171</td>
<td>***</td>
</tr>
<tr>
<td>IgA</td>
<td>−0.30 (0.13)</td>
<td>0.06 (0.10)</td>
<td>NS</td>
<td>0.83</td>
<td>***</td>
</tr>
<tr>
<td>Pre</td>
<td>4.50 (2.17)</td>
<td>4.13 (1.61)</td>
<td>NS</td>
<td>0.189</td>
<td>***</td>
</tr>
<tr>
<td>Post–pre (g/l)</td>
<td>−1.15 (0.87)</td>
<td>−0.21 (0.65)</td>
<td>****</td>
<td>0.26</td>
<td>***</td>
</tr>
<tr>
<td>IgM</td>
<td>−0.31 (0.14)</td>
<td>−0.03 (0.18)</td>
<td>NS</td>
<td>0.26</td>
<td>***</td>
</tr>
<tr>
<td>Pre</td>
<td>2.03 (0.86)</td>
<td>2.04 (0.84)</td>
<td>NS</td>
<td>2.38</td>
<td>***</td>
</tr>
<tr>
<td>γ Globulin</td>
<td>15.64 (7.00)</td>
<td>15.54 (4.69)</td>
<td>****</td>
<td>2.43</td>
<td>***</td>
</tr>
<tr>
<td>Pre</td>
<td>−0.35 (0.17)</td>
<td>−0.07 (0.17)</td>
<td>NS</td>
<td>0.262</td>
<td>***</td>
</tr>
<tr>
<td>Lymphocyte</td>
<td>1.82 (0.80)</td>
<td>1.38 (0.61)</td>
<td>NS</td>
<td>0.18</td>
<td>***</td>
</tr>
</tbody>
</table>


| Table 1 Pretreatment value, decrease, decrease ratio, and threshold value of immunoglobulin levels and lymphocyte count in patients used to differentiate between patients with and without adverse reactions. Values are shown as mean (SD) | IgG | With adverse reaction | Without adverse reaction | p Value | Threshold value | p Value |
|-----|----------------------|-------------------------|---------|----------------|---------|
| Pre | 5.00 (2.17)          | 4.13 (1.61)             | NS      | 0.189          | ***     |
| Post–pre (g/l) | −0.35 (0.17) | −0.07 (0.17) | NS | 0.262          | ***     |
| IgA | −0.31 (0.14)         | −0.03 (0.18)            | NS      | 0.26           | ***     |
| Pre | 2.03 (0.86)          | 2.04 (0.84)             | NS      | 2.38           | ***     |
| γ Globulin | 15.64 (7.00) | 15.54 (4.69) | **** | 2.43           | ***     |
| Pre | −0.35 (0.17)         | −0.07 (0.17)            | NS      | 0.262          | ***     |
| Lymphocyte | 1.82 (0.80) | 1.38 (0.61) | NS | 0.18            | ***     |