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## Magnetic resonance imaging guided corticosteroid injection of sacroiliac joints in patients with spondylarthropathy. Are multiple injections more beneficial?

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**Abstract** Efficacy of a second magnetic resonance (MR) imaging guided corticosteroid injection of inflamed sacroiliac joints (SIJ) in patients with spondylarthropathy. Thirty-one patients received 50 injections in an outpatient basis. Fifteen of 31 patients who relapsed or were non-responders received a second injection. All had MR-guided injection of 40 mg triamcinolone acetonide into SIJ using an open 0.2 Tesla unit. Twenty of 31 patients after the first injection, and 9 of 15 patients after the second injection reported subjective improvement, which lasted for a mean of  $8.7 \pm 10.9$  and  $16.1 \pm 15.8$  months for each group. Subchondral bone marrow edema resolved in 15 of 20 patients who reported subjective improvement, after the first injection. No complications occurred. MR guided steroid injection of SIJ is effective and safe. Since there is no exposure to radiation it could be performed many times. Repeated injections seem to be beneficial for primary non-responders and patients who relapsed.

**Keywords** Magnetic resonance imaging · Corticosteroid reinjection · Spondylarthropathy · Sacroiliac joints

### Introduction

Spondarthropathies (SpA) are a heterogenous group of inflammatory disorders, which mainly affect the spine

and entheses and usually begin in young adults. Inflammation of one or both sacroiliac joints (SIJ) and inflammatory back pain are typical features of SpA [1, 2]. The treatment of SpA is still inadequate and consists mainly of non-steroidal anti-inflammatory drugs (NSAID) and physiotherapy. The disease modifying anti-rheumatic drugs (DMARD) are not clearly effective, especially in axial disease [3]. In recent studies, treatment with anti-TNF- $\alpha$ -agents resulted in significant and sustained improvement but whether they will prevent the structural damage remains to be shown [4–7].

The therapy of sacroiliitis with local steroid injection is safe and effective [8–11]. In a previous work, we showed that the magnetic resonance (MR) imaging is a suitable and safe technique for local corticosteroid injection of SIJ [12]. Here, we present our preliminary experiences with special focus on repetitive injection of corticosteroids. In this small sample, we confirmed the feasibility of MR guided steroid administration into the SIJ and assessed the efficacy of a second injection in non-responders and patients who relapsed.

### Materials and methods

Thirty-one patients fulfilling the modified New York and European spondylarthropathy study group criteria [13, 14] were included in the study (18 men, 13 women, mean age at onset:  $24.7 \pm 7.9$  years). All patients had been taking NSAID and/or DMARD without adequate control of complains for at least 6 months. They had persistent inflammatory back pain which was poorly controlled. Inflammatory back pain was defined as by Calin et al. [15]. Nineteen of 31 patients were HLA-B27 positive. All injections were performed on an outpatient basis. Twelve patients were injected unilaterally. All patients provided written informed consent and the investigations have been performed in accordance with the principles of the Helsinki Declaration.

The conventional radiographic degree of sacroiliitis was not evaluated. Only patients with subchondral bone

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**Table 1** Patients' characteristics before intraarticular treatment

Patient	Sex	Age at onset (years)	Disease duration (years)	HLA-B 27	Mennell's sign	ESR (mm/h)	CRP (mg/dl)	Edema on MRIa
1	M	29	10	+	-	8	0.2	++
2	M	10	17	+	+	20	5.39	++
3	M	25	10	+	+	8	2.25	++
4	M	15	10	+	+	6	2.84	++
5	M	24	2	-	+	20	0.2	++
6	F	25	3	+	+	4	0.2	++
7	M	35	6	+	-	9	0.2	++
8	F	32	2	-	-	2	0.2	+++
9	F	32	28	-	+	32	3.20	++
10	F	24	5	+	+	20	0.2	+++
11	F	23	10	+	+	29	1.29	++
12	M	23	1	+	-	6	0.2	++
13	M	22	3	+	+	96	10.76	++
14	M	19	10	+	+	20	2.95	++
15	F	13	12	+	+	13	0.78	+++
16	M	25	2	+	+	66	1.18	++
17	M	28	2	+	+	3	0.2	++
18	M	28	13	-	+	38	3.32	+++
19	F	30	16	+	+	20	0.93	++
20	F	58	3	-	+	6	0.2	++
21	M	55	10	-	+	6	1.31	+
22	F	19	2	-	+	36	3.30	++
23	M	22	11	+	+	8	0.5	++
24	F	25	2	+	+	6	0.2	+++
25	M	19	2	-	-	8	1.17	++
26	M	18	3	-	+	16	1.32	++
27	F	27	13	-	-	9	0.2	+++
28	F	30	2	-	+	6	1.2	+
29	F	11	6	+	-	7	0.2	++
30	M	23	5	-	-	6	0.2	++
31	M	25	2	+	+	7	0.2	++

a + slight, ++ moderate, +++ marked edema.

marrow edema on MR imaging and refractory pain were included in the study. The following grading system was used for MR evaluation: + slight edema, ++ moderate edema and +++ marked edema. Table 1 shows patient characteristics before corticosteroid injection of the SIJ.

All patients had MR guided injection of 40 mg triamcinolone acetonide into each inflamed SIJ with a MR compatible therapy needle (0.9×100-mm Somatex, Berlin, Germany) using an open 0.2 Tesla unit (MR open: Siemens, Erlangen, Germany). Patients who relapsed and the non-responders received a second injection. The time interval between the first and the second injection was at least 3 months. The corticosteroid injections were done according to a protocol, which was described in detail elsewhere [12].

The clinical examinations were done at the beginning and every 6–10 weeks for a minimum of 12 months. Mennell's sign [16] and the anterior flexibility of the lumbar spine, according to the Schober method [17], were assessed. The degree of inflammatory back pain was assessed by a visual analog scale (VAS) with a range from 0 to 10 (most severe pain: 10). The patient was defined as a responder, if the subjective pain index showed at least 50% improvement on VAS.

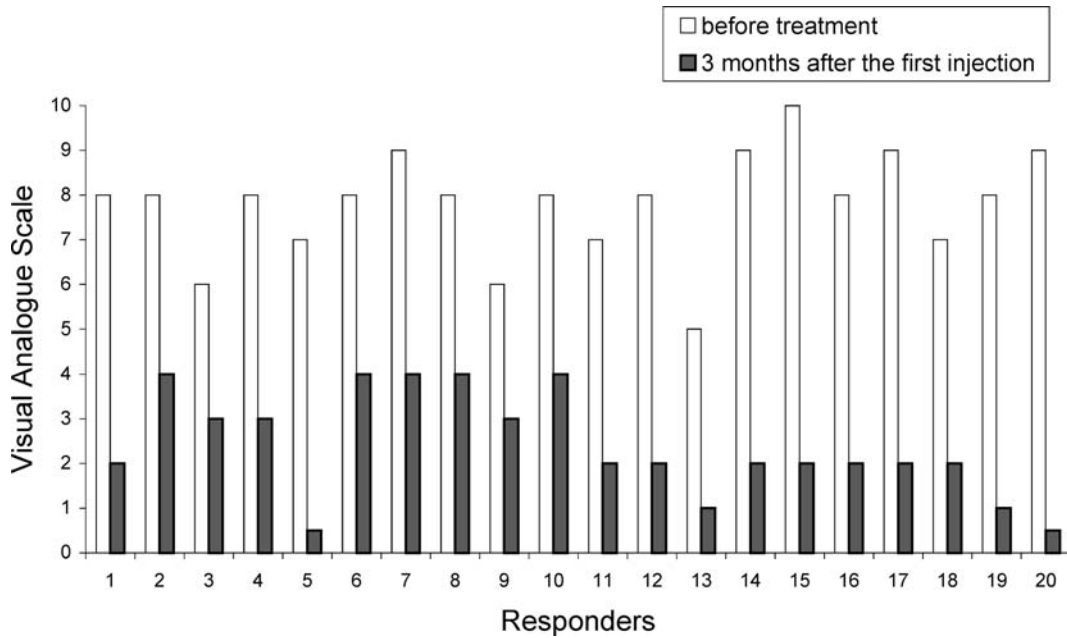
A high-field MR examination of SIJ was done before and 3 months after each corticosteroid injection using a

1.5 Tesla unit (Magnetom Sonata or Magnetom Vision; Siemens) with T1 weighted images (TR/TE: 430/12 ms) and T2 weighted images (TR/TE: 3300/17–120 ms, slice thickness 4 mm). Fat suppressed inversion recovery sequences were additionally performed with TR/TE/TI: 4800/22–90/180 ms and 4 mm slice thickness. The laboratory examinations including C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), HLA-B27 and anti-nuclear antibody (ANA) were performed by conventional methods.

## Results

Twenty of 31 patients after the first injection and 9 of 15 patients after the second injection reported subjective improvement, which lasted for a mean of  $8.7 \pm 10.9$  and  $16.1 \pm 15.8$  months for each group, respectively (Figs. 1 and 2). The mean VAS values were  $7.9 \pm 1.2$  before the first injection ( $n=31$ ),  $4.1 \pm 2.5$  after the first injection ( $n=31$ ) and  $3.5 \pm 2.1$  after the second injection ( $n=15$ ), respectively.

After the first injection, the subchondral bone marrow edema resolved in 15 of 20 patients who reported subjective improvement, whereas it resolved in 5 of 11 patients who were non-responders. The subchondral bone



**Fig. 1** Subjective back pain index in 20 of 31 patients who benefited from the first intra-articular injection (0 pain, 10 very severe pain)

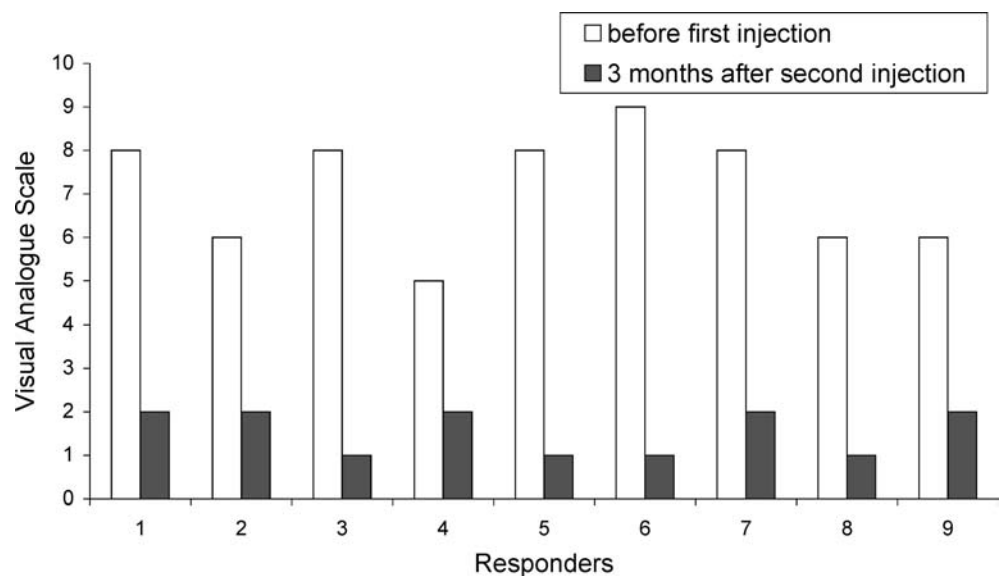
marrow edema resolved in four of nine patients who were responders after the second injection.

There were no significant differences in assessment of laboratory parameters including CRP and ESR, before and after treatment. In 16 patients CRP and in 12 patients ESR were elevated (normal  $<0.6$  mg/dl and  $<15$  mm/h) and did not change significantly after the local steroid injections. The mean values before, after the first and after the second infiltrations for CRP were:  $1.5 \pm 2.1$ ,  $0.9 \pm 1.0$  and  $1.2 \pm 1.0$  and for ESR:  $15.3 \pm 14.7$ ,  $12.7 \pm 10.6$  and  $15.6 \pm 13.0$ , respectively. In one patient, the initially high ESR and CRP measure-

ments (96 mm/h and 10.76 mg/dl) returned to normal levels after a single injection of both SIJ. There was no correlation between clinical findings and laboratory parameters.

Only one of three patients with concomitant fibromyalgia responded to local steroid injection. Menell's sign was improved in 16 of 31 patients, whereas the Schober test was unchanged in all patients. Nearly half of the patients reported gastrointestinal intolerance to NSAID (two patients with inflammatory bowel disease). In 13 patients, the NSAID therapy could be stopped. The local treatment was well tolerated and no adverse events were noticed. Three patients described the procedure as painful or very painful. Five patients reported transient increase of pain for about 24 h.

**Fig. 2** Subjective back pain index in 9 of 15 patients who responded to the second intra-articular injection (0 pain, 10 very severe pain)



## Discussion

The mean duration between the first clinical signs of sacroiliitis and the development of radiological changes in the SIJ varies between 5 years and 9 years [18, 19]. However, an early diagnosis is essential since it may help ensure patient education, avoidance of unnecessary investigation and more important induce early and effective treatment.

Early sacroiliitis can be demonstrated by MR imaging in SpA before the abnormalities are seen by conventional radiography. At present, MR imaging is considered to be the best technique able to demonstrate both, acute and chronic changes in SIJ. It is the most sensitive and specific method to evaluate SIJ in terms of inflammation [20–22].

Although high costs and the relatively long duration of this procedure limit its use, MR seems to be suitable not only in diagnosing but also managing sacroiliitis. In a previous work, we showed for the first time, that interventional MR is a useful and safe method for local steroid injection of the SIJ [12]. In that small pilot study the inflammatory low back pain could be reduced for a mean duration of 10 months. It is important to note that this technique is not associated with irradiation and no serious side effects have been observed.

In this study, we present our experience with more patients confirming our former data. Since this method is safe and without irradiation, the non-responders and the patients who relapsed received a second injection. The laboratory findings including CRP and ESR did not change significantly, irrespective of whether the patients were responders or not, which means the injections showed no systemic effects. An interesting result of the present study was, that the patients with a second steroid injection reported longer subjective improvement than the patients with only one injection ( $16.1 \pm 15.8$  versus  $8.7 \pm 10.9$  months). In addition, some patients showed a partial reduction in inflammation on MR imaging, which could mean that the dosage of corticosteroid was not sufficient. We do not know whether a higher dosage of local steroids, i.e. 80–100 mg, could lead to better results. Of course, shortcomings of our study are the small sample size, heterogeneity of the patients and lack of randomisation and of a placebo treated control group. Furthermore, dynamic magnetic resonance imaging which needs application of the contrast agent gadolinium-DTPA intravenously could be a more specific method to diagnose and to follow-up sacroiliitis [11].

Luukkainen et al. [23] evaluated the efficacy of periarticular corticosteroid injection in patients with sacroiliitis. They showed in their double blind controlled study that periarticular corticosteroid treatment of the SIJ is effective; however, the number of patients in their study was low. Although the results of their study are preliminary they are encouraging. In our study, we could reduce the time needed for steroid infiltration of SIJ to

**Table 2** Patient groups suitable for a MR-guided steroid injection of sacroiliac joints

Isolated sacroiliitis
Young patients
Patients with drug intolerance and allergy to contrast agents
Spondyloarthritis concomitant with inflammatory bowel disease

approximately 30 min for bilateral injections depending on the individual patient. Since we need less time to perform a periarticular infiltration, it is important to compare it with intraarticular injections.

Bollow et al. [24] performed computed tomography (CT) guided intraarticular steroid injection into the SIJ of children and observed clear clinical improvement. They pointed out that this technique has to be performed by experienced hands in order to minimize the length of the procedure, since radiation exposure is a concern in children. In this group of patients, MR-guided steroid injection could be a logical option as well as in patients with inflammatory bowel disease, drug intolerance or allergy to contrast agents (Table 2).

TNF- $\alpha$  is the key proinflammatory cytokine involved in the pathological inflammatory processes of ankylosing spondylitis [25]. Using CT guided sacroiliac biopsies Braun et al. [26] showed that TNF- $\alpha$ -RNA is increased in inflamed SIJ of patients with SpA. In recent studies, TNF- $\alpha$ -blocking agents induced dramatic improvement of enthesitis and associated osteitis as shown on MRI [4, 27]. These findings suggest that TNF- $\alpha$ -blockade is not only effective in suppressing synovitis, but also in enthesitis, the hallmark of SpA. However, some serious adverse events, i.e. severe infections, malignancies, demyelinating disorders, congestive heart failure and hypersensitivity reactions need to be considered. In order to prevent such side effects, a useful option would be the local application of these potentially effective agents [28]. Recently, Kellner et al. [29] reported that local injection of infliximab into SIJ is safe and technically feasible. They installed 60 mg infliximab in the inflamed SIJ of five patients with ankylosing spondylitis. Inflammatory pain improved in all patients and MR imaging showed a decrease of subchondral bone edema. Local application of these substances in sacroiliitis is a promising idea and should be tested in future controlled trials.

In conclusion, MR guided local steroid injection is effective and safe, carrying no risks in skilled hands. It could be performed many times without drawbacks of radiation exposure. Repeated injections seem to be more beneficial. Future controlled studies should determine, whether MR guided steroid injections result in significantly more clinical improvement compared to the conventional methods.

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