Concise report

Ultrasound-guided sacroiliac joint injection in patients with established sacroiliitis: precise IA injection verified by MRI scanning does not predict clinical outcome

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Abstract

Objective. IA injections of SIJs with corticosteroids are often performed in patients suffering from low back pain due to active sacroiliitis. However, SIJ injections are technically demanding, and therefore the clinical outcome of ultrasound-guided corticosteroid SIJ injections was analysed in relation to the accuracy of the injection.

Methods. Ultrasound-guided injections were performed with 40 mg triamcinolone and 0.78 mg gadolinium in 20 SIJ of 14 consecutive patients suffering from active sacroiliitis. Immediately following SIJ injection, MRI scanning was initiated to verify the correct placement of the drug. Clinical outcome of the intervention was determined using a numerical pain rating scale (NRS) at Days 1 and 28.

Results. Despite ultrasound guidance, only 8 injections (40%) were exactly positioned into the SIJ space, whereas the other 12 injections (60%) missed the SIJ. However, there were no significant differences observed in the clinical outcome between the IA-injected group and the peri-articular-injected group. There was similar pain relief observed in both groups 24 h and 28 days following the intervention [IA injection group: mean NRS-baseline: 6.8 (range 4–9), NRS-24 h: 4.3 (range 1–7) and NRS-day 28: 3.5 (range 1–5); peri-articular injection group: mean NRS-baseline: 7.0 (range 5–10), NRS-24 h: 4.1 (range 1–10) and NRS-day 28: 4.5 (range 1–8)].

Conclusion. These results demonstrate that IA SIJ injections remain technically challenging despite ultrasound guidance. However, peri-articular deposition of triamcinolone appears sufficient for pain and symptom control in patients suffering from active sacroiliitis.

Key words: Sacroiliitis, Ultrasonography, Intra-articular injection, Spondyloarthritis.

Introduction

Sacroiliitis is a common manifestation of SpAs [1, 2] and its treatment remains a therapeutic challenge. Besides systemic therapies including NSAIDs and biologic agents, IA injections of SIJ with corticosteroids are often performed for pain relief [3]. Image guidance of the SIJ injection seems to be important, due to the complex anatomy of the joint causing a low accuracy when performed according to clinical judgement only [4]. The feasibility of ultrasound-guided injections of SIJs has been recently demonstrated resulting in very high success rates up to 90% [5, 6]. However, the success of these interventions has been determined according to the therapeutic efficacy, and the correct placement of the drug has not been evaluated in these studies. Therefore, we determined the clinical outcome of 20 ultrasound-guided SIJ...
injections in relation to the accuracy of the injection as controlled by MRI scanning.

Materials and methods

Study cohort
In this study, 14 consecutive patients presenting to our department with low back pain due to acute sacroiliitis were enrolled. The study was approved by the clinical research ethics committee of the University of Regensburg, and all patients gave informed consent prior to enrolment in this study.

Ultrasound-guided IA SIJ injection
All injections were performed by one of the authors (W.H.). For injection, the patients were positioned in a prone position. After disinfection of the skin, ultrasound examination was performed using Logiq 9 ultrasound equipment from GE (General Electric Healthcare, Chalfont St Giles, UK) with a linear array transducer (9L) working with 2.5–8.0 MHz frequency with a field of view of 44 mm. Focus and penetration depth were adjusted according to the anatomical landmarks and the region of interest. The visualization of the SIJ cleft was performed according to a scanning technique previously proposed [5, 6]. Following delineation of the SIJ cleft, a 20 gauge needle (0.9 × 70 mm, Braun, Melsungen AG, Melsungen, Germany) was led under ultrasound guidance in a free-hand technique to the gap and local anaesthesia was applied with 1 ml of scandicain 1%. Then we tried to insert the needle further into the joint space. Holding the needle in the best achievable position, injection of 1 ml (40 mg) triamcinolone and 2 ml (0.78 mg) gadolinium (Artirem; Guerbert AG, Zürich, Switzerland) was performed.

MRI scanning for verification of IA SIJ injection
Immediately following the intervention, MRI scanning of the SIJ was initiated to verify the correct placement of the drug. All MRI examinations were performed at a 1.5 Tesla MR scanner (Magnetom Symphony TIM; Siemens Healthcare, Erlangen, Germany) with a gradient field strength of 30 mT/m (rise time 0.24 ms, slew rate 125 T/m/s). The patients were examined in the supine position. Spine and body-phased array coils were used for signal detection. At the beginning of the examination, a T1-weighted localizer was acquired in three planes, which was used for planning the following sequences.

A T1-weighted spin echo (SE) sequence with spectral fat saturation in transverse orientation (3:05 min, TR = 532 ms, TE = 12 ms, slice thickness 4 mm, field of view (FOV) 320 mm and pixel size 1.3 × 0.6 mm) and a T2-weighted turbo SE (TSE) sequence in transverse orientation (3:29 min, TR = 5930 ms, TE = 105 ms, slice thickness 4 mm, FOV 320 mm and pixel size 1.3 × 0.6 mm). On these sequences a para-coronal T1-weighted TSE sequence with spectral fat saturation (3:05 min, TR = 760 ms, TE = 9.6 ms, slice thickness 4 mm, FOV 310 mm and pixel size 1.2 × 1.2 mm) was planned parallel to the SIJ.

Measurement of clinical outcome
Clinical outcome of the intervention was determined utilizing a numerical pain rating scale (NRS) ranging from 0 (no pain) to 10 (most severe pain). The intensity of low back pain was recorded by the patients 1 day before and 1 day after the intervention, as well as after 28 days.

Statistical analysis
The Mann–Whitney U-test was utilized for statistical analysis. P ≤ 0.05 was considered statistically significant.

Results

Patient characteristics
Ultrasound-guided injections were performed in 20 SIJ of 14 patients suffering from low back pain due to acute uni- or bilateral sacroiliitis. The female to male ratio was 1:1, and the mean age was 43.1 (range 19–71) years. All patients suffered from relevant inflammatory low back pain (NRS > 4) according to the Calin criteria [7]. The inflammation of the SIJ was verified by MRI scanning within 4 weeks prior to the intervention. The underlying diagnoses were AS (n = 6), uSpA (n = 6), PsA (n = 1) and enteropathic arthritis (n = 1). The mean disease duration at the time of intervention was 2.5 (range 0.3–10.0) years.

Ultrasound-guided IA SIJ injection verified by MRI scanning
Despite utilization of ultrasound guidance during injection of 20 SIJ, MRI scanning revealed that only 8 injections were exactly positioned into the SIJ space (40%), whereas the other 12 injections (60%) missed the SIJ space as demonstrated by peri-articular localization of gadolinium. Typical MRI images for IA and peri-articular drug deposition during the intervention are depicted (Fig. 1A and B). No patient had application of gadolinium peri- and IA at the same time.

The intervention was well tolerated in all patients and no major side effects were observed. One patient with peri-articular injection complained about temporary numbness of the lower extremity lasting for ~1 h.

Clinical outcome following ultrasound-guided SIJ injection
Overall, the mean pain score was determined at 6.9 (NRS 0–10) on the day before the intervention, decreased to 4.1 after 24 h and remained at 3.9 28 days following the intervention, demonstrating a significant therapeutic response observed in all patients (P = 0.003 and P = 0.009, respectively). Surprisingly, stratification for IA and peri-articular injection revealed no significant difference in clinical outcome between patients with IA and peri-articular drug deposition, respectively. There was no significant difference in the baseline pain scores between both groups (NRS 6.8 vs 7.0, respectively). In addition, similar pain relief could be documented in both groups.
24 h following the intervention (NRS 4.3 vs 4.1), and there was only a trend for a sustained clinical response after 4 weeks in patients with confirmed IA injection (NRS 3.5 vs 4.5, respectively).

**Discussion**

Sacroiliitis is the most common manifestation of SpAs and the major cause of inflammatory back pain. NSAIDs, being the first line of therapy, are often not sufficient for disease control, or cannot be applied for a prolonged period due to gastrointestinal and cardiovascular side effects [8]. If sacroiliitis is the only manifestation, anti-TNF-α treatment might appear too aggressive considering potential side effects. As several studies have demonstrated a good clinical short- and long-term response to IA SIJ injections [9–12], local therapy is an excellent alternative treatment for symptomatic sacroiliitis [9–12].

Due to the complex anatomy, SIJ injections have a very low success rate of 12–20%, if performed by clinical judgement only [4, 13]. Besides fluoroscopy guidance [14, 15] CT guidance [12, 16] and MRI guidance [12, 16–18], ultrasound imaging has been recently applied to place the needle into the SIJ space. An increasing success rate with regard to the correct positioning of the needle starting from 60% at the first 30 injections up to 93.5% with the last 30 injections has been demonstrated, but the therapeutic efficacy or clinical outcome of this intervention has not been evaluated [5]. In addition, the feasibility of ultrasound-guided SIJ injections has been reported by other investigators demonstrating a success rate of 80% in a cadaver study, in which the exact positioning of the needle was controlled by CT scanning [6]. In the second part of this study, 10 patients with established SpA and unilateral symptoms of sacroiliitis underwent sonography-guided SIJ injection. Substantial pain relief has been observed in all patients, and therefore the authors concluded correct IA placement of the drug in these patients. However, correct IA SIJ injection has not been confirmed in these patients either by CT or by MRI scanning.

With regard to these studies, we determined the clinical outcome of ultrasound-guided SIJ injections in relation to the accuracy of the injection. Utilizing MRI scanning immediately following ultrasound-guided SIJ injection, the success rate of correct IA SIJ injection was 40% in our cohort. This is a substantially lower number compared with the previously published studies, but still twice as good as determined for SIJ injections based on clinical judgement only [4, 13]. One reason might be the remarkably higher age of the patients enrolled in our study (43 vs 25.6 and 26 years, respectively). It is well known that degenerative alterations in the SIJ accumulate with age resulting in a mixture of inflammatory and OA lesions including bony spurs that make the precise placement of the needle into the SIJ space more difficult. In addition, we also had not performed a cadaver pre-study to optimize the technical handling of the ultrasound-guided SIJ injections.

In accordance with the previous studies, significant pain relief could be observed in our study group following SIJ injection. However, an excellent and sustained therapeutic response has been reported previously in 10 patients treated with SIJ injections [6]. Even when compared with our subgroup of patients with documented IA SIJ injection, the previously reported patients had a much better outcome. The cause of these differences remains elusive; however, all patients included in our study suffered from active sacroiliitis demonstrated by MRI scanning, whereas patients with suspected sacroiliitis based on clinical findings have been enrolled in other studies. Therefore, patients suffering from functional or degenerative disorders might also have been included in these studies, contributing to the excellent results.

There was no obviously significant difference with regard to clinical improvement in IA and peri-articular-injected patients in our study. On first sight, this finding seems astonishing, but there are several studies demonstrating a good clinical response to peri-articular corticosteroid injection of the sacroiliac joint [19, 20].
with these observations, a superior effect has been documented following peri-articular lidocaine injections compared with fluoroscopy-guided IA injections in 50 patients with SIJ pain [21]. In addition, previous and recent studies have demonstrated that neural innervations and nociceptors are not only located in the joint capsule, but are also present in the posterior ligamentous tissue, thus establishing these structures as additional sources of pain due to sacroiliitis [22, 23]. Furthermore, histological studies revealed that only the distal third of the SIJ resembles some characteristics of a synovial joint, whereas the major part of the SIJ can be considered as syndesmosis [24]. One can assume that not only the synovial part of the SIJ is affected during sacroiliitis, but also the inter-osseous ligaments, which could also contribute to the clinical efficacy of peri-articular injections.

In conclusion, the present results demonstrate that IA SIJ injections remain technically challenging despite ultrasound guidance. However, peri-articular deposition of triamcinolone appears sufficient for pain and symptom control in patients suffering from inflammatory low back pain due to active sacroiliitis.

**Rheumatology key messages**

- Despite ultrasound guidance SIJ injections remain technically challenging.
- Peri-articular deposition of triamcinolone also appears effective for pain control.

Disclosure statement: The authors have declared no conflict of interest.

**References**