

# Sacroiliac Joint Ablation Using MR-HIFU

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**Abstract** The sacroiliac joint is the culprit in 15–30% of patients with chronic lumbar back pain. Ablation of the posterior sensory nerves supplying the joint is an established treatment option before arthrodesis. We report the successful application of MR-HIFU in a patient with therapy-refractory pain using the Sonalleve MR-HIFU system. The outpatient procedure was performed under spinal anaesthesia and analgosedation. The ramus dorsalis of L5 as well as the lateral branches of the ramus dorsalis S1–S3 was targeted, and tissue peak temperature per sonication was controlled using MR-thermometry. There were no post-interventional complications. Clinical improvement began 4 days post-intervention with complete resolution of the pain after 1 month.

**Keywords** HIFU · SIJ · Chronic back pain · Nerve ablation

## Introduction

Chronic back pain is a widespread disorder with a variety of underlying causes. Several studies have identified the sacroiliac joint (SIJ) as the culprit in 15–30% of cases [1, 2]. The same applies to patients with persistent pain after vertebral body fusion [3]. The gold standard for diagnosis is the image-assisted injection of local anaesthetic, either fluoroscopically or CT controlled, whereby a >50% reduction in pain is diagnostic for SIJ dysfunction. Radiofrequency ablation (RFA) of the posterior nerves supplying the SIJ (ramus dorsalis of L5 as well as lateral branches of the ramus dorsalis S1–S4) has been successfully applied in patients refractory to conservative therapy as a means to avoid or postpone arthrodesis [4]. For this purpose, several ablation needles are placed through the skin lateral to the sacral neuroforamen to create a strip lesion along the sacrum [5]. To our knowledge, there are no reports of HIFU denervation of the SIJ in humans [6].

## Case Report

A 75-year-old female patient with persistent left-sided chronic back pain after bilateral microsurgical decompression of L4/L5 and L5/S1 as well as dorsal spondylodesis of L5–S1 1.5 years ago was referred to interventional radiology for refractory pain treatment. She complained of lumbar pain that was not radiating down her legs. Twofold CT-guided infiltration of the left SIJ during the past year had shown unequivocal improvement of her pain. On the visual analogue scale (VAS), she rated the pain 4–9 out of 10.

Informed consent was obtained from the patient for the procedure as well as use of her data for research purposes.

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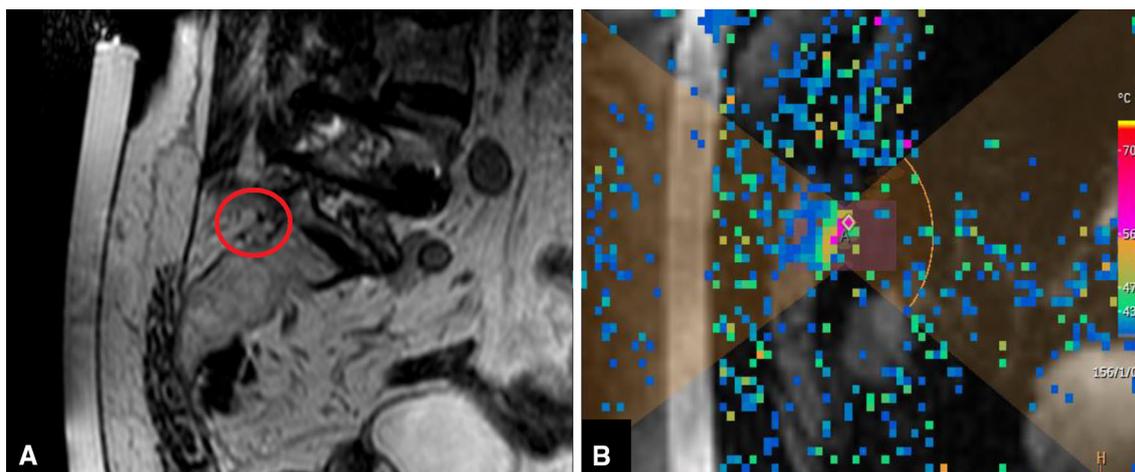
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**Fig. 1** **A** T2-weighted planning sequence at treatment level lateral to the sacral neuroforamen. The outermost white curvilinear line on the image left with direct contact to the skin corresponds to the gel cushion of the HIFU table. The red circle frames the targeted posterior neurovascular bundle at S1 level. Artifacts at L5/S1 are caused by the spondylolysis. **B** Snapshot during sonication. The

transparent orange triangles that reach to the edges of the picture correspond to the sound range in the near and far field. The narrowest point between these triangles (analogous to the focus in diagnostic ultrasound) is the treatment focus. The coloured pixels correspond to the degree of heating (MR-thermometry) with a corresponding scale on the right edge of the image

The procedure was performed under spinal anaesthesia and due to claustrophobia additionally with analgosedation using propofol. A Sonalleve MR-HIFU system with an in-table 1.2-MHz transducer (Profound Medical Corp, Mississauga, Canada) was used with a 1.5-T MR system (Philips, Amsterdam, Netherlands). The physician had 9 years of experience in MR-HIFU interventions. Planning was performed using a sagittal 3D T2w TSE Image (TR 1000 ms, TE 130 ms field of view AP 250 mm FH 250 mm RL 132 mm, bandwidth 832 Hz) in the paramedian plane directly lateral to the sacral neuroforamen. The ramus dorsalis of L5 as well as the lateral branches of the ramus dorsalis S1–S3 was targeted. A total of 8 therapeutic sonications were performed with 4-mm treatment cells (volume of 0.1 ml) and 60–120 W power. Tissue peak temperature per sonication was targeted to be over 60° (Fig. 1) and controlled through live feedback via MR-thermometry. The total duration of the intervention was 38 min. No contrast agent was administered. The patient was discharged home the same day with a prescription for NSAIDs. Clinical improvement began 4 days post-intervention. There were no post-interventional complications. After 1 month, the SIJ pain had completely resolved and the patient was able to discontinue her oral pain medications. The last clinical follow up was after 6 months, where she was still free of symptoms.

## Conclusion

Advantages of this new ablation technique compared to RFA are the non-invasiveness since no needle placement is necessary, no radiation for patient as well as staff, superior

visibility of the target structures, and direct treatment feedback using MR-thermometry. Procedure time is comparable to RFA [5]. MR-HIFU of the posterior SIJ-supplying nerves permits non-invasive thermal ablation and can be used as an alternative to RFA in patients with chronic SIJ pain. Outcome was very successful in the 6-month clinical follow up. Further studies will need to assess the feasibility in larger patient cohorts as well as the long-term therapeutic effect.

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## Compliance with Ethical Standards

**Conflict of interest** The authors declare that they have no conflict of interest.

**Informed Consent** Informed consent was obtained from all individual participants included in the study.

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