MR Guided Cryosurgery of the Sacroiliac Joint: Technique and Early Clinical Results

J.E. ROY1, M. HESS2, C. MOISAN1

1IMRI unit, Centre hospitalier universitaire de Québec, 10 de l’Esplan Street, Québec City, Québec Canada; 2Orthopedic Hospital Munich-Harlaching, Klinik München-Harlaching, Munich, Germany;

Introduction
The diagnosis and treatment of chronic low back pain remains a challenge due to the absence of specific clinical tests and a pathognomonic clinical picture[1, 4]. Of all patients presented with a chronic low back pain, the incidence of sacroiliac pain represents about 13%[5]. The common treatment, refractory to a treatment with NSAIDs and physical therapy, still consists of simultaneous intraarticular injection of local anesthetic and corticosteroids [2]. However, no consensus has yet emerged on the treatment of severe and incapacitating pain of sacroiliac joint origin. Various treatment modalities, such as arthrodesis, radiofrequency denervation, and neural ablation, have been proposed. None of these have demonstrated positive long-term results. In this context, our group is assessing the potential of cryoanalgesia under direct MR guidance as an alternate therapeutic approach. The objectives of this pilot prospective nonrandomized clinical trial were therefore (a) to develop a technique for MR guided cryosurgery of the sacroiliac joint and (b) to determine the outcome in a first group of patients with severe chronic pain of sacroiliac joint origin. The technique is based on the assumption that the sacroiliac joint is innervated by fine nerve branches derived exclusively from the dorsal rami of the spinal nerves at the S1-S4 levels [3, 4]. Lethal thermal stress is delivered to those nerves under near-real-time MR guidance, which enables an accurate localization of the cryogenic source at the target level, as well as a direct monitoring of the ice ball in reference to the local anatomic structures during the freezing cycle.

Methods
Patient selection criteria included: 1) a chronic low back pain for at least one year; 2) a VAS-Score over 4; 3) an Oswestry Disability Score over 40%; and 4) an adequate answer to double-blind intraarticular SIJ-blocks with lidocaine (improvement of pain of at least 50%) and water (no placebo response). Four patients, three women and one man, in an age range of 40 to 61 years and with chronic low back pain since 70 to 330 months were recruited in the pilot study. They were offered an informed consent was obtained. The technique involves positioning the patient prone on the table of a 0.5T open-configuration MRI system (SIGNA SP/i; GE Medical Systems). All imaging is performed using the near-real-time mode of this system. Details of the image acquisition include using a 2D-GRE sequence, a flip angle of 80°, a FOV 30 x 30 cm, a matrix 256 x 128, 1 NEX, and a slice thickness of 5 mm. This results in a refresh rate of 4sec/image. Two MR compatible cryogenic probes of 3 mm diameter (CryoHit; Galili Medical, Israel) are hence guided towards the target sacroiliac joint. The first entry point is marked using the interventionist fingers as pointing devices in the image field of view. One to two fingers are placed below the inferior margin of the sacroiliac joint. After the skin is anesthetized a stitch incision is done and a first cryoprobe is introduced. Under MR guidance, the cryoprobe is advanced in a cephalic direction until its tip comes lying adjacent to the dorsal sacroiliac ligaments covering the caudal part of the joint. The second skin entry point is then marked to overlap with the tip of the first probe, the interventionist positions one finger medially to the dorsal joint line. This cryoprobe is then directed laterally to cover the cephalic part of the joint. Figure 1 shows the positioning of the cryoprobe in axial (a) and oblique sagittal (b) views.

Once the probes are placed on target, two active freezing cycles of 7 minutes each at a target temperature of -150°C interleaved by a passive thawing of 2 minutes, are delivered to induce lethal damage to local nerve branches. The resulting ice ball is monitored continuously in near-real-time mode in axial and oblique sagittal views. The probes are finally removed and the skin is closed. The procedures were carried on an outpatient basis and no special postoperative care was necessary.

Results
The duration of the procedure ranged from 35 to 50 minutes with a median time of 43 minutes. No skin lesions caused by burning or other adverse effects or complications were noted. The four patients included in the study were available for a clinical follow up 6 weeks and 6 months postoperatively. Every patient reported an initial worsening of their low back pain for typically 2 to 3 weeks, followed by a later decrease of the chronic pain. Figure 2 shows the median VAS-Score multiplied by 10 as well as the median Oswestry Disability Score plotted against the follow up time. Error bars show the lower and upper values observed.

Discussion
In this study we introduced a novel approach in the treatment of severe sacroiliac pain. The cryoanalgesia technique combines state-of-the-art cryotherapy technology with the advantages of peroperative MR guidance. Initial clinical results demonstrate a pain relief of 58% per patient and a noticeable improvement in quality of life (50% improvement of the Oswestry Disability Score). Every patient would undergo this procedure again, two of them are waiting for the treatment of the other sacroiliac joint.

References