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ORIGINAL ARTICLE

Ultrasound-Guided Versus Fluoroscopy-Guided Sacroiliac Joint Intra-articular Injections in the Noninflammatory Sacroiliac Joint Dysfunction: A Prospective, Randomized, Single-Blinded Study

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Abstract

Objective: To compare the short-term effects and safety of ultrasound (US)-guided sacroiliac joint (SIJ) injections with fluoroscopy (FL)-guided SIJ injections in patients with noninflammatory SIJ dysfunction.

Design: Prospective, randomized controlled trial.

Setting: University hospital.

Participants: Patients (N = 120) with noninflammatory sacroiliac arthritis were enrolled.

Intervention: All procedures were performed using an FL or US apparatus. Subjects were randomly assigned to either the FL or US group. Immediately after the SIJ injections, fluoroscopy was applied to verify the correct placement of the injected medication and intravascular injections.

Main Outcome Measures: Treatment effects and functional improvement were compared at 2 and 12 weeks after the procedures.

Results: The verbal numeric pain scale and Oswestry Disability Index improved at 2 and 12 weeks after the injections without statistical significances between groups. Of 55 US-guided injections, 48 (87.3%) were successful and 7 (12.7%) were missed. The FL-guided SIJ approach exhibited a greater accuracy (98.2%) than the US-guided approach. Vascularization around the SIJ was seen in 34 of 55 patients. Among the 34 patients, 7 had vascularization inside the joint, 23 had vascularization around the joint, and 4 had vascularization both inside and around the joint. Three cases of intravascular injections occurred in the FL group.

Conclusions: The US-guided approach may facilitate the identification and avoidance of the critical vessels around or within the SIJ. Function and pain relief significantly improved in both groups without significant differences between groups. The US-guided approach was shown to be as effective as the FL-guided approach in treatment effects. However, diagnostic application in the SIJ may be limited because of the significantly lower accuracy rate (87.3%).

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Sacroiliac joint (SIJ) dysfunction is an underappreciated source of low back or buttock pain.[1,2] Although low back pain often is thought of as idiopathic, specific pain generators can be identified in approximately 75% of those with chronic low back pain.[3] Although there is no true criterion standard for the diagnosis of SIJ-originated pain, intra-articular (IA) fluoroscopy (FL)-guided injections have been considered to be the most plausible method of diagnosis.[4] Image guidance of the SIJ IA injection seems to be important because of the complex anatomic nature of the joint, causing a low diagnostic accuracy when performed according to clinical judgment. Furthermore, with the accuracy rate of only

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22% in patients, image guidance seems to be crucial in improving the success rate of the procedure.[5] FL, computed tomography (CT), or magnetic resonance imaging has been recommended for the image-guided procedures.[6-8] In recent years, ultrasound (US) has extended its application from a diagnostic tool to a highly accurate imaging tool in localizing injections.[9,10] The advantages of US include exposure without radiation, real-time visualization of soft tissues, visualization of the needle tip advancement and local anesthetic spread relevant to the surrounding structures.[11]

The frequency of inadvertently injected intravascular steroid injections has been reported to range from 2.5% to 9% during CESI (cervical epidural steroid injections).[12,13] Although aspirating the needle for blood may avoid intravascular drug injections, such a technique is neither sufficiently sensitive nor specific to significantly avoid an intravascular needle position. Color Doppler was used to avoid intravascular injections to overcome such a limitation. Yoon et al[14] reported that vascular injection occurred if the injection flow was not detected as being mainly in the cephalad direction, and if the vascular flow was detected as having multicolored spectrums by the color Doppler. Using such identification method, Yoon[14] reported a successful injection rate of 94%, and in 3 other unsuccessful cases, they reported that positional changes of the needle occurred after exchanging the syringe.

Previous studies demonstrated that the US-guided SIJ injection method was feasibly applicable. They show similar success rates between the methods in terms of the extracapsular lesion and IA injections,[15,16] with a 76.7% overall success rate for the US-guided approach.[17] However, previous studies had limitations in that they lacked either controls or subjects for elucidating clinical significance.[15-17] Therefore, a randomized controlled trial to compare the accuracy, effectiveness, and safety of US imaging with a widely used imaging technique such as CT or FL seems necessary to elucidate the clinical significances in pain, functional improvement, and safety of the US-guided SIJ IA procedure.

Hence, a prospective, randomized, single-blinded clinical trial was conducted to evaluate the short-term pain improvement resulting from US-guided SIJ IA injections, compared with that from FL-guided SIJ IA injections, in patients with noninflammatory SIJ dysfunction. In addition, patient satisfaction, the accuracy rate, functional improvement, and the incidence of intravascular injection were also assessed as secondary outcomes.

Methods

Participants

After obtaining approval and registering for a clinical trial with the institutional review board, 120 patients were enrolled into this prospective, randomized, single-blinded study. Between June 2011 and June 2012, 154 patients who had chronic low back pain (>3mo) without radiculopathy were evaluated for SIJ dysfunction. The patients, referred by medical practitioners, neurosurgeons, or orthopedists for further diagnosis and treatment, received a diagnosis based on the medical history, image findings, and physical examinations. Inclusion criteria were as follows: (1) pain located laterally over the SIJ line; (2) positive findings on at least 1 of 3 provocation tests for SIJ pain—Gaenslen's test, Patrick's test, and Newton's test; (3) negative response to Kemp's test (pain provocation tests for sciatica); (4) no disorders in the hip joint; (5) no signs of lumbar radiculopathy; (6) radiographic degenerative joint disease; (7) and pain reduction >80% after diagnostic SIJ injection.[18,19] Patients were excluded if they (1) had systemic inflammatory disease (ankylosing spondylitis, psoriatic arthritis, or Reiter syndrome); (2) were receiving anticoagulant therapy; (3) had uncontrolled diabetes, due to the adverse effects of steroids; (4) had prior allergic reactions to lidocaine or contrast media; (5) had suspected or diagnosed infection or avascular necrosis of the femoral head; (6) were in poor general health; (7) were unable to come to the hospital for follow-up visits; (8) had skin defects on the injection area; (9) had psychiatric problems that prevented completion of the study related questionnaires; (10) had prior injections within 3 months; (11) required anti-inflammatory medication other than acetaminophen; or (12) were undergoing supplementary therapeutic intervention during the study period that might affect the treatment effects such as additional peripheral injections or surgery.

List of abbreviations:

CT	computed tomography
FL	fluoroscopy
IA	intra-articular
ODI	Oswestry Disability Index
SIJ	sacroiliac joint
US	ultrasound
VNS	verbal numeric pain scale

Random sampling

Participants were randomly assigned into either the US or FL group using a computer-generated randomization table. Individuals in both the US-guided SIJ IA injection group and the FL-guided SIJ IA injection group were to receive 0.5mL of nonionic contrast media (Omnipaque 300[a]) plus 2mL of the following mixture: 1.0mL of 0.5% lidocaine plus dexamethasone 10mg.

Baseline US technique

All of the US examinations and the US- and FL-guided SIJ IA injection procedures were conducted by 1 physician (Y.P.) with more than 7 years of experience in both techniques. All treatments were performed as an outpatient procedure. Accuvix XQ[b] with a linear probe at 6 to 12MHz for color Doppler mode was used as the US instrument.[15,17]

US scanning was performed by posteriorly placing the transducer with the patients in a prone position. First, a baseline US was performed to identify bony landmarks by depiction of the bony contours of the posterior superior iliac spine laterally and the spinous process of the fifth lumbar vertebra medially by axial transducer positioning. The transducer was moved caudad to depict the dorsal surface of the sacrum and the median and lateral sacral crest, the gluteal surface of the ilium, and the first posterior sacral foramen. From this level, the transducer was moved downward until the second posterior sacral foramen was visualized.[16] Thorough observation of the vessels inside or around the posterior portions of the SIJ was conducted with a color Doppler US to avoid intravascular injections (fig 1).

US-guided SIJ IA injections

The spinous process of the fifth lumbar vertebra was taken at the initial anatomic landmark. The transducer was moved caudad from the spinous process of the fifth lumbar vertebra over the