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A new technical contribution for ultrasound-guided injections of sacro-iliac joints

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Abstract. – *Introduction:* **Sacroiliac joint (SIJ) represents a difficult location for local therapies, as intra-articular injections may be hard to execute, especially in particular conditions such as chronic inflammatory diseases. Howevewr, in selected patients, local therapies may be considered. Some recent studies demonstrated the feasibility of ultrasound (US)-guided injection of SIJ, but still a complete explanation and definition of the technique is needed.**

Materials and Methods: **Seven patients, four males and 3 females, affected by mono or bilateral sacroiliitis entered the study. Each patient received 40 mg of acetonide triamcinolone for each SIJ, intra articular (IA) US-guided injection. The technical originality proposed in this study consists in the spinal needle insertion in the middle of the cranial long side of the linear transducer with an orientation of about 10°, determining shorter needle insertion for reaching joint space and consequently probably granting lesser pain and traumatism for patients.**

Results: **A total of 22 injections was performed. The longer follow-up time obtained was 18 months in 3 patients. All patients reached at least a 6 month follow-up. All patients reported an amelioration in pain that lasted for at least 6 months. No systemic adverse events were reported or observed. Complete visualization of SIJ and of needle placement was performed by US imaging, while compound proper injection was also visualized by Color-Doppler US imaging.**

Discussion: **Actually, sacroiliac joint intra-articular injections are often performed under fluoroscopy or Computerized Tomography guidance. Such techniques present several limitations, especially for repeated injections, such as the use of ionizing radiations, the need of a contrast agent and the direct and indirect costs connected. US guidance in IA SIJ injections may represent an easily repeatable imaging technique for needle placement and a precious tool for detecting inflammatory activity of the joint.**

Key Words:

Sacro-iliac, Ultrasound, Intra-articular injections.

Introduction

Sacroiliac joint (SIJ) represents a difficult location for local therapies, as intra-articular (IA) injections may be hard to execute, especially in particular conditions such as chronic inflammatory diseases[1-4]. Guidelines for sacroiliac joint inflammatory diseases suggest that systemic therapies are more appropriate as sacroiliac involvement often represents just an aspect of a systemic disease. The use of the anti-inflammatory drugs or biological therapies is recommended not only for a symptomatic resolution but, more than that, for the control of articular damage caused by the underlying disease[5]. In selected patients, where systemic therapies are not feasible options or where the patients are non-responders to conventional therapies, and especially in patients where only SIJ is still active in terms of inflammation despite systemic therapy, local therapies may be considered[6]. In fact, usually, these patients present severe algic and functional conditions caused by the SIJ involvement, with an important reduction in quality of life and work ability. It is

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then important to reduce such disfunctions by any means, and local therapies are feasible options.

Sacroiliac joint injections are rarely performed, due to the difficulty in achieving joint space. Rosenberg et al.[7] demonstrated by a double-blind study an intraarticular success rate of 22% only among hand free SIJ injections. Image guidance seems then to be an essential tool to optimize intraarticular success rate of SIJ injections. The use of fluoroscopic imaging, CT imaging or magnetic resonance imaging has been employed by previous Authors for image-guided needle placement. In 2003, Pekkafahli et al.[8], assessed the value of ultrasound (US) guidance for intraarticular injection, reporting a success rate of 76.7% when controlled by fluoroscopic imaging. Conversely, 23.3% of injections were performed extraarticularly. Klauser et al.[9] also reported similar results when analyzing via CT on human cadavers if needle placement was correct using US guidance. Many previous studies demonstrated that CT or fluoroscopic guidance may be helpful in effectuating intra-articular injections in SIJ[10,11], but irradiation of both patient and operator makes these techniques not easily repeatable. Sparing of radiations is also recommended by EURATOM[13], when other techniques that grant lesser irradiations are available for exerting similar functions.

Ultrasound guidance for intra-articular SIJ injection may represent a safe and easily repeatable option for patients needing a local approach for their joint disease, as it spares irradiation and still grants a direct vision of the localization of the needle and of the injected drug. Economical aspects of performing such injections via ultrasound guidance are to consider as well. Some recent studies[14] demonstrated the feasibility of ultrasound-guided injection of SIJ, but still a complete explanation and definition of the technique is needed, in order to achieve a correct standardization of the technique itself.

Materials and Methods

Seven patients, four males and three females, affected by mono or bilateral sacroiliitis entered the study. Four of them were affected by ankylosing spondilitis, three by seronegative spondiloarthritis, according to ACR criteria. Four patients were not eligible for standard systemic therapies, 3 patients partially responded to standard systemic therapies and still presented mono or bilateral sacroiliitis. Each patient received 40 mg of acetonide triamcinolone for each SIJ IA US-guided injection. All patients signed an informed consent before entering the study. Diagnosis of sacroiliitis was performed by clinical examination and MRI examination. All patients compiled at baseline a pain VAS score regarding sacroillitis-connected pain and same compilation was performed at each control visit, that was performed each 3 months after first injection. Further injections were performed each six months. Local or systemic adverse events were recorded at every visit.

Injection Technique

All patients lied in prone position with a pillow placed under the abdomen in order to straighten lumbar lordosis. Operator and ultrasound screen were both positioned on the left side of the patient. A medium-high frequency (7 MHz), linear transducer (Esaote, MyLab25, Genova, Italy) was chosen for this procedure. Skin was disinfected with iodated alcohol and draped. Sterile gel was placed on the skin.

The ultrasound transducer was oriented in transverse orientation on the sacral hiatus and then the sacral cornae were identified. Subsequently, by shifting the transducer laterally we were able to identify the lateral edge of the sacrum. Always maintaining the transducer in transverse rotation, we followed the edge cephalically, identifying then the bony contour of ileum. The space observed between the two bony contours represents the posterior ultrasound aspect of sacroiliac joint. Consequently, rotating transducer caudally made identifiable posterior cauda of sacroiliac joint, where injection should be performed. The posterior cephalic part of the SIJ appears by moving the transducer towards cephalic direction. Orientation of needle was 10° inclined respect to sagittal orientation of transducer (Figure 1). The needle was strictly followed by ultrasound guidance until the edge of the needle reached sacroiliac joint. The orientation of the cleft also gives useful information regarding the needle orientation to use in order to penetrate the joint. When needle reached the cleft, another needle insertion of about 1 cm was effectuated. Not only ultrasound guidance allowed correct needle placement but once injection was started ultrasound imaging allowed the detection of eventual extraarticular placement of

Figure 1. Injection technique showing both transducer orientation and needle injection.

compound. Color Doppler may also be useful in this phase, as it shows direction of injected drug. No other imaging techniques were utilized in this study to confirm correct placement of needle and compound, such as fluoroscopy and CT.

Results

A total of 22 injections was performed. Main characteristics of patients are shown in Table I. The longer follow-up time obtained was 18 months in 3 patients. All patients reached at least a 6 month follow-up. Data regarding pain VAS scores are referred in Table II.

All patients reported an amelioration in pain that lasted for at least 6 months.

No systemic adverse events were observed in the 6 months follow-up. 2 patients, for a total of 2 injections, reported a transient local pain in the site of injection that lasted for 2 days and that spontaneously disappeared without adding any medication. No ecchymosis were observed in the injection sites.

Complete visualization of SIJ and of needle placement was performed by US imaging, while compound proper injection was also visualized by color-Doppler US imaging.

Discussion

Many previous studies demonstrated the efficacy and safety in terms of success rate of imaging in guiding needle placement for sacroiliac joint. Previous imaging processes utilized CT, MRI and fluoroscopy as imaging devices[7,10,11,15]. Intra-articular injection proved to be effective in inducing pain-relief and disease modification in different conditions where sacroiliac joint inflammation represents a disease expression. A correct needle placement is obviously necessary in order to achieve such results, and placement itself is difficult to execute without imaging guidance, due to complexity and heterogeneity of anatomy of SI joints. Also, anatomical modifications induced by diseases, as bony spurs and joint space narrowing, make the injection often difficult, especially in patients where disease duration is longer. Hand free SI joint intra-articular injections success rate is of 22% only when controlled by CT[7]. Image-guided injections are then preferable in terms of success, as Dussault et al.[15] reported, with a 97% success rate in 31 fluoroscopically guided injections on 24 patients. MRI proved to be effective as well, as reported by Gu'naydin et al.[12]: such Authors performed intra-

Table I. Characteristics of patients affected by sacroiliitis undergoing to US-guided SIJ injection.

	Age	Gender	Diagnosis	Years of disease	Laterality	Unresponsive to systemic therapies	Not eligible to systemic therapies	Number of SIJ injections
1	48	Male	AS	3	Left	No	Yes	2
2	42	Male	AS	4	Right	Yes	No	3
3	28	Male	SSA	1	Bilateral	No	Yes	2
4	36	Male	AS	3	Right	No	Yes	2
5	52	Female	AS	3	Bilateral	No	Yes	4
6	48	Female	SSA	8	Bilateral	Yes	No	6
7	46	Female	SSA	3	Left	No	Yes	3

Table II. Results in terms of pain VAS.

Pain VAS scores obtained for patients undergoing to SIJ US-guided injections			
Patients	**Baseline**	**3 months**	**6 months**
p1	7	5	3
p2	9	3	2
p3 left	8	3	4
p3 right	8	3	2
p4	7	2	4
P5 left	9	3	3
p5 right	9	3	3
p6 left	8	3	4
p6 right	8	3	2
p7	9	4	3
Mean	8.2	3.2	3

articular injections in 16 SIJ and demonstrated good results. Obviously not only CT inflicts to patients and operators an amount of ionizing radiations, but also, as MRI, such imaging techniques have a cost, and this makes the repeating of such injections, often needed in patients affected by sacroiliitis, hard to sustain. Other studies proved the efficacy of US in image guiding of SIJ intra-articular injection; Pekkafahli et al.[8] reported a good success rate for US guidance after fluoroscopic control, while Klauser et al.[9] also reported good results on cadavers by the use of sonoanatomic landmarks. Harmon and O'Sullivan[14] reported a different injection technique with good results in one patient. Differently from what reported by Harmon and O'Sullivan, we used a 7 MHz linear transducer (Esaote, MyLab25, Genova, Italy) and when organizing setting for injection, independently from the side to inject, both operator and US machine were placed on the left side of patient. Again, differently from what reported by Harmon and O'Sullivann, the spinal needle was inserted in the middle of the cranial long side of the transducer; this transducer orientation along with the needle placement seems to grant a shorter insertion of the needle for reaching joint space, thus probably granting lesser pain and traumatism for patients. Furthermore, we performed our injections using a 20 Gauge spinal needle instead of a 22 Gauge needle.

As reported in such previous studies, also in our experience US guidance, when implemented with Doppler functions, enabled the detection of inflammatory patterns and added value to the diagnostic process.

But there's not only costs or time needed to perform CT, MRI and fluoroscopic guidance behind better feasibility of repeated US guided intra-articular injections. Another important issue to pay attention to is radiations. Ionizing radiations exposure under fluoroscopy and CT may vary from 10 to 30 mGy/minute for the skin[8,9]. US guidance obviously grants radiations avoidance, and this is particularly important for patients that need repeated intra-articular interventions and for pediatric or young patients. Also MRI grants radiations sparing, but costs and procedure time make such technique more expensive and not easily repeatable.

We have to acknowledge several limitations for this preliminary study. First, population object of our study is small. For ethical reasons, no control CT scan for assessing correct intra-articular needle positioning was conducted in our patients. Despite this, an important pain relief was observed in our patients, suggesting a correct steroid placement.

Again, anatomical variants and disease-related modifications of joint space make the correct needle placement hard to execute. The introduction of new kits for needle placement under US guidance could be useful for increasing success rate.

Conclusions

Actually, SIJ intra-articular injections are often performed under fluoroscopy or CT guidance. Such techniques present several limitations, especially for repeated injections, such as the use of ionizing radiations, the need of a contrast agent and the direct and indirect costs connected. US guidance in intra-articular SI injections may represent an easily repeatable imaging technique for needle placement and a precious tool for detecting inflammatory activity of the joint.

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