

Peer Review File

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Review Comments:

The research question is a very important one. The paper would benefit greatly from more information in both the methods and results section. Please see specific questions below.

<Title and throughout paper>

Comment 1: “Contrast-enhanced” MRI “using gadolinium” is redundant. Consider dropping one. Also would consider changing using to “with gadolinium.”

Reply 1: Thank you for your recommendation. According to your recommendation, we deleted “using gadolinium” throughout the whole manuscript except method section which was also edited as “with gadolinium”.

Changes in the text:

Please refer to the "revised manuscript" because of its huge size.

<Introduction>

Comment 2: First sentence, lines 50-53, is misleading and the cited reference does not support it, given that the study shows that CT is not a good predictor of facet joint pain. The remainder of the paragraph goes on to explain this, however the first sentence should be reworked.

Reply 2: Thank you for your comments. We edited manuscript according to your comments as follows.

Changes in the text:

Radiologic imaging techniques can identify a given source of pain or distinguish it from other possible sources of pain, however, it is controversial especially in patients with lumbar facet joint (LFJ) disease (1-4). This discrepancy results from degenerative changes found in patients with LFJ disease that are frequently also found in asymptomatic patients, making it difficult to clearly identify sources of pain (1-4). Therefore, proper assessment of LFJs is important for patients with LFJ pain.

Comment 3: Paragraph 3, line 66. Specifically list the treatment that you are analyzing.

Reply 3: Thank you for your comments. We edited manuscript according to your comments as follows.

Changes in the text:

In this study, we aimed to evaluate the correlation between contrast-enhanced MRIs and treatment outcomes for LFJ intraarticular (IA) steroid injections. We

present the following article in accordance with the MDAR reporting checklist.

<Methods>

Comment 4: Need to indicate that this is a retrospective study. Description makes it sound prospective.

Reply 4: Thank you for your comments. We edited manuscript according to your comments as follows.

Changes in the text:

Methods

The patients were recruited retrospectively and consecutively based on injection charts of the spine center of a university hospital between March 2012 and September 2018 according to the following criteria:

Comment 5: Please provide more detail regarding selection criteria. How were these patients initially found?

Reply 5: Thank you for your comments. The patients were recruited retrospectively and consecutively between March 2012 and September 2018 according to the inclusion criteria based on injection chart of the spine center of a university hospital. We edited manuscript according to your comments as follows.

Changes in the text:

Methods

The patients were recruited retrospectively and consecutively based on injection charts of the spine center of a university hospital between March 2012 and September 2018 according to the following criteria:

Comment 6: Were patients with any disc herniation or spinal stenosis excluded? Or just symptomatic?

Reply 6: Thank you for your comments. In case of the patients with disc herniation or lumbar spinal stenosis, the patients whose pain did not match with the characteristics of the LFJ pain were excluded. To avoid misunderstanding to the readers, we edited method section according to the reviewer's comments as follows.

Changes in the text:

The exclusion criteria for the current study were patients with allergy to contrast materials, spinal instability, coagulopathy, any uncontrolled psychiatric or medical condition, and rheumatic diseases. Also, in case of the patients with disc herniation or lumbar spinal stenosis, the patients whose pain did not match with the characteristics of the LFJ pain were excluded.

Comment 7: The fact that all patients have had a positive MBB does somewhat confuse results and may actually be a limitation. Even with some false positives of a single MBB, patients who have responded positively to MBBs should have a very

high rate of proven facet mediated pain. It is not that surprising that they didn't show significant differences in response despite MRI findings... they all have known facet joint pain. Were the MBBs all performed at the same level as the injections?

Reply 7: We totally agreed with the reviewer's comments. Therefore, we added limitation according to your comments. Also, The MBBs all performed at the same one level as the injection; in detail, we conducted each injection at one level based on the results of the MBB.

Changes in the text:

Therefore, we tried to investigate the clinical ability of contrast-enhanced MRI to predict the effects of treatment effect for LFJ pain in the current study. However, the results of our study showed that contrast-enhanced MRI did not correlate with a positive treatment outcome in patients with LFJ pain. However, we can possibly suggest some hypotheses about some positive treatment effects of a selective diagnostic block to each LFJ pain location, and these could make no correlation between contrast-enhanced MRI findings and LFJ steroid injection outcomes.

Comment 8: Line 74- MRI is not a treatment

Reply 8: Thank you for your comments. We edited manuscript according to your comments as follows.

Changes in the text:

patients who had been conducted contrast-enhanced lumbar spine MRI that showed spondyloarthropathy;

Comment 9: What sequences were included in the MRI scans? Provide technical parameters if available. What field strength were they performed on?

Reply 9: Thank you for your comments. We edited manuscript in detail according to your comments as follows.

Changes in the text:

Patients were classified into facet joints with enhancement and non-enhancement groups, based on contrast-enhanced MRI scans with gadolinium (Fig. 1). MRI data were obtained using a 1.5-T scanner (Magnetom Vision, Siemens, Erlangen, Germany) with a spine array coil. Spin-echo sequences, axial and sagittal T1- [583/12 (repetition time ms/echo time ms)], turbo T2-weighted images (3800/128), and contrast (Magnevist), 0.2mL/kg of gadopentetate dimeglumine (Bayer Healthcare Pharmaceuticals) enhanced axial T1-weighted images were obtained. The grading criteria for osteoarthritis of the facet joint was also used, and four categories are shown as follows:

Comment 10: Line 81-81 (and elsewhere in paper). The terms “enhanced” vs “non-enhanced” groups is confusing. All scans were be enhanced if gadolinium was given. Do you mean facet joints with enhancement vs non-enhancement?

Reply 10: Thank you for your comments. We edited whole manuscript, figure 2 and tables according to your comments as follows.

Changes in the text:

Please refer to the “revised manuscript” because we edited throughout the whole manuscript which had a lot of volume.

Comment 11: Specifically where did you look for enhancement? Was enhancement graded in any way or just a yes/no?

Reply 11: Thank you for your comments. Two radiologists, who were unaware of the treatment results, independently assessed the LFJ enhancement as yes or no. We edited manuscript as follows.

Changes in the text:

Patients were classified into facet joints with enhancement and non-enhancement groups, based on contrast-enhanced MRI scans with gadolinium (Fig. 1).

Comment 12: Line 92. Agreement between radiologists was not reported in results.

Please provide.

Reply 12: Thank you for your comments. There was 96.1% agreement between the two radiologists about the enhancement and 92.3% agreement about grading for osteoarthritis of the LFJs. However, the Cohen's kappa score for the agreement of two radiologists about the enhancement was 0 and the Cohen's kappa score for the agreement of two radiologists about grading for osteoarthritis of the LFJs 0.88 with a 95% confidence interval is (0.72,1.00). Usually it is known that Cohens Kappa is known to have limitations for skewed datasets. So, there was 96.1% agreement between the two radiologists about the enhancement, however, the Cohen's kappa score for the agreement of two radiologists about the enhancement was 0. To avoid misunderstanding to readers, we edited manuscript as follows.

Ref) Domenic V.Cicchetti, Alvan R.Feinstein. High agreement but low kappa: II. Resolving the paradoxes. J Clin Epidemiol. 1990;43(6):551-8.

Changes in the text:

Methods

Two radiologists, who were unaware of the treatment results, independently assessed the LFJ enhancement and osteoarthritis grading.

Results

There was 96.1% agreement between the two radiologists about the enhancement and 92.3% agreement about grading for osteoarthritis of the LFJs.

Comment 13: How many joints were injected in each patient? Which joints? How was this decided?

Reply 13: Thank you for your comment. In our spine center of a university, we usually conducted only one level of the MBB and steroid injection. We decided level of the MBBs according to the physical exams including paraspinal tenderness and MRI imagings. And the steroid injections were all performed at the same one level as the MBBs; in detail, we conducted each injection at one level based on the results of the MBB.

Changes in the text:

Methods

The patients were recruited retrospectively and consecutively based on injection charts of the spine center of a university hospital between March 2012 and September 2018 according to the following criteria: lumbar axial pain persisting for more than six months without radicular symptoms; age: 21–79 years; more than three on the numerical rating scale (NRS); a minimum of 80% temporary pain improvement for a minimum of 30 minutes after a selective diagnostic block with 0.5 mL of 1% lidocaine to each LFJ pain location (9);

<Results>

Comment 14: How many joints showed enhancement in each patient? Did you inject the exact same joints that had enhancement? Did you only the enhancing joints, or

those plus more? Need more information.

Reply 14: Thank you for your comment. In our spine center of a university, we usually conducted only one level of the MBB and steroid injection. We decided level of the MBBs according to the physical exams including paraspinal tenderness and MRI imagings. And the steroid injections were all performed at the same one level as the MBBs; in detail, we conducted each injection at one level based on the results of the MBB. To avoid misunderstanding to the readers, we edited manuscript as follows.

Changes in the text:

An aseptic IA corticosteroid injection was administered using C-arm fluoroscopic guidance (Siemens, Erlangen, Germany) with a posterior approach. The IA injection was performed at the same one level as the selective diagnostic block. After the patient was lying down in a prone position using a comfortable pillow under the abdomen to straighten the lower lumbar spine, the C-arm fluoroscopy was placed in an oblique and cephalad position until the LFJ space could be seen clearly.

Comment 15: How many of the injections were intra-articular vs peri-articular?

Reply 15: Thank you for your comment. We recruited patients retrospectively and consecutively based on injection charts. Because we performed IA corticosteroid injection using C-arm fluoroscopic guidance, all injections were conducted intra-articularly. By using an IA injection of 0.3 mL of contrast material to confirm

correct IA LFJ access, 10 mg (0.25 mL) of dexamethasone with 0.5 mL of 0.25% bupivacaine was injected to the LFJs.

Changes in the text:

An aseptic IA corticosteroid injection was administered using C-arm fluoroscopic guidance (Siemens, Erlangen, Germany) with a posterior approach. The IA injection was performed at the same one level as the selective diagnostic block. After the patient was lying down in a prone position using a comfortable pillow under the abdomen to straighten the lower lumbar spine, the C-arm fluoroscopy was placed in an oblique and cephalad position until the LFJ space could be seen clearly.

Comment 16: Line 134. Please provide the specific p-value.

Reply 16: Thank you for your comment. We edited manuscript according to your comments as follows.

Changes in the text:

We also compared the treatment outcomes between two groups; however, we saw no significant difference between the enhancement and non-enhancement groups from pretreatment to 3 months after treatment ($p=0.746$).

Comment 17: Lines 141-162. The discussion of the pros and cons of various imaging

modalities for facet joint imaging is unnecessary. Would delete everything unrelated to MRI.

Reply 17: Thank you for your comment. We edited manuscript according to your comments as follows.

Changes in the text:

Many radiologic imaging techniques have been used to diagnose LFJ pain, and MRI is a nonionizing and noninvasive method that produces images with a good soft tissue resolution (12,15). MRIs have an excellent advantage for evaluating the immediate consequences of LFJ degeneration, including adjacent bone edema, active synovial inflammation and neural structure impingement, enhancement of the LFJ rim, LFJ effusion, subchondral bone edema, and wraparound bumper osteophyte formation (12,15). In addition, some studies have reported that the enhancement of the LFJ rim with gadolinium can lead to more accurate diagnoses for synovitis (12,15).

Comment 18: Lines 221-222. Lumbar facet degeneration is known to be more common in older patients, however it is unclear what you are suggesting in this sentence. It seems that you are hypothesizing that biomechanical changes lead to this LFJ degeneration? While this may be true, there is no data provided in this study that would support this claim.

Reply 18: Thank you for your comments. We deleted sentence which could make misunderstanding to the readers according to your comments.

Changes in the text:

Therefore, in the current study, we saw an agreement with this hypothesis in that the enhancement group showed a significantly higher older age than the non-enhancement group.

Comment 19: Agree, the sample size is small. Did you perform a power analysis?

Reply 19: Thank you for your comments. We did not perform a power analysis. We edited limitation section according to your comments as follows.

Changes in the text:

However, the current study was performed retrospectively with a small number of patients without calculation of sample size, so larger studies with randomized control are recommended for the future. In addition, further clinical outcome measures, including patient functionality or quality of life are recommended.

Comment 20: Line 226. No correlation between contrast enhancement and LFJ steroid injection outcomes

Reply 20: Thank you for your comments. We edited manuscript according to your

comments as follows.

Changes in the text:

This study is the first trial evaluating the correlation between contrast-enhanced MRIs and treatment outcomes for LFJ IA steroid injection outcomes.