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CT-Guided Lumbar Facet Joint Infiltration: Accessibility, Accuracy and Functional Outcome

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Abstract

Background: Pain generated from lumbar facet joint affection is considered a common cause of low back pain. Image-guided facet joint infiltration is performed to reduce pain severity and to confirm its source. **Aim:** The objective of this study is to assess the accessibility, and accuracy and to evaluate the functional outcome of the CT-guided lumbar facet joint infiltration in management of low back pain. **Subjects and Methods:** This retrospective study included thirty four patients. All patients were diagnosed with low back pain due to lumbar facet syndrome. Adequate conservative therapy failed to improve the patient's symptoms. Totally, 81 lumbar facet joints were treated by CT-guided intra-articular infiltration. Mean time of hospital stay was 6 - 8 hours. In the procedure technique, measures were applied to reduce the patients' radiation exposure. The response to treatment was evaluated by the visual analogue scale (VAS) before procedure and at follow-up visits. **Results:** Among 34 adult patients included in this study, 26 were males and 8 were females. The mean age was 49.5 ± 8.5 years. Mean Duration of low back pain on admission was 8.2 ± 3.5 months. Bilateral CT-guided intra-articular infiltration was performed in 23 patients (67.5%). Assessing the response after facet joint infiltration, 82.4% of the patients showed immediate pain improvement after the procedure; 85.3% of the patients reported pain relief after 1 month and 67.6% at 12 month follow up. There was a statistically significant relief of pain after the intervention at 12 month follow up ($p < 0.001$). **Conclusion:** Lumbar Facet joint infiltration guided with CT scanning seems to be a reliable and safe procedure for low back pain management. Beside immediate and long term pain relief achieved using this minimally invasive technique; CT guidance provides an accessible and accurate route for the needle with low radiation dose exposure.

Keywords

Low Back Pain, Accuracy, CT, Lumbar Facet Joint

1. Introduction

Pain emerging from facet joint is considered as a common cause of axial low back pain in adults with a prevalence rate ranging from 15% to 52% [1] [2]. Pain may be generated from any part of the facet joint as the fibrous capsule, bone and the synovial membrane [3].

Facet joint-mediated pain is not easy to diagnose; physical examination and radiological findings are unreliable to confirm the diagnosis of facet joint syndrome. Many surgeons diagnose facet joint pain mainly by clinical examination and by excluding other causes of axial low back pain [4] [5]. Image-guided facet joint interventions have emerged rapidly as noninvasive nonsurgical techniques with a reliable diagnostic and therapeutic means [6].

These interventions include ultrasound-guided, fluoroscopy or computed tomography scanning. Optimum precise localization of the needle tip can be achieved through the image guidance; also undesirable complications can be avoided [7]. Intra-articular facet joint infiltrations are beneficial for the diagnosis and management of facet joint pain. On the other hand, other nonsurgical procedures as neurolysis and radiofrequency denervation of medial branch nerves are mainly used to treat rather than to diagnose facet joint pain [8].

Considering the microanatomy of the lumbar facet joint and osteoarthritis presence which leads to difficulty in obtaining accurate precise needle access by fluoroscopy only, computed tomography (CT) scanning provides a minimally invasive, proper needle guidance and reliable precise needle placement in the axial plane with high anatomic resolution [9].

The aim of the present study is to review the accessibility and technical accuracy of the procedure and to evaluate the clinical outcome after intervention.

2. Subjects and Methods

Thirty four patients were included in this retrospective series, 26 males and 8 females, their mean age was 49.5 ± 8.5 years. All the procedures were performed at Cairo University hospital and Ahalia hospital in the period from 2014 to 2016. Ethical approval was obtained by Neurosurgery ethical review committee in our institution, and informed consent was not required to this retrospective study. All patients were evaluated clinically and radiologically before the intervention.

Patients included in this study suffered axial low back pain due to lumbar facet syndrome for a duration ranging from 3 to 14 months (mean duration: 8.2 ± 3.5 months), not responding to conservative treatment and they all had CT-guided intra-articular facet joint infiltration. Before the intervention, the involved facet joint showed signs of degeneration and inflammation in magnetic resonance imaging (MRI). Exclusion criteria included other causes of low back pain as herniated disc, spinal deformity, spondylolithesis, and radicular symptoms, history of any neurological deficits, possible pregnancy, coagulation defect and previous spinal surgeries.

11 patients (32.5%) had unilateral CT-guided lumbar facet joint infiltration

and 23 (67.5%) had the intervention bilaterally. The total number of facet joints injected was 81.

Back pain was assessed using Visual Analogue Scale (VAS) before procedure and immediate post procedure. We instructed the patients to attend in our out-patient clinic 3 - 4 weeks after the intervention for control evaluation and after 6, 12 months for follow-up. Patient's demographic data was shown in Table 1.

3. Procedures

Patients were placed in prone position and the angle of CT scanner was adjusted to be 0 angle. In order to reduce radiation exposure to the patients, an initial low dose scan was applied to the targeted facet joint with average length of 6 cm only per level obtaining 5-mm axial sections. Using the light marker in the CT scanner, needle entry point on the skin was localized. After skin has prepped and draped, local anesthesia was administrated and a 22-G needle was advanced into the joint in slight oblique (5 - 10 degrees) or straight direction. Needle angulations are determined according to the facet joint inclination until it reaches the lip of the facet joint. Fine maneuver was followed to enter the facet joint capsule to minimize number of scans taken. We used intraarticular contrast only in five cases to confirm needle position as in most of cases the CT scanning verified the joint line clearly. In the bilateral infiltration cases, both sides' needles were inserted before scanning. Low-dose (120 kV, 60 mAs) scans were performed intermittently in step-and-shoot mode over the limited planned targeted area to verify the needle position. 0.5 ml of 0.25% bupivacaine and 0.5 ml (20 mg) of methylprednisolone acetate were injected into the intra-articular facet joint. Post procedural, the patient was observed for 1 hour to observe the pain relief and to detect any possible complication like allergic reactions (Figure 1 and Figure 2).

4. Statistical Analysis

Statistical analysis was done using IBM SPSS statistics version 24. Numerical data were presented as mean ± standard deviation and range. Categorical data were presented as frequencies and percentages. Comparison of VAS score overtime was done by Cochrane test. A probability value (p value) less than 0.05 was

Table 1. Patient's demographic data.

Data	Value	No.	%
Mean Age (y)	Mean ± SD	49.5 ± 8.5	
	Range	37 - 63	
Sex	Male	26	76.5
	Female	8	23.5
Mean duration of pain (M)	Mean ± SD	8.2 ± 3.5	
	Range	3 - 14	
Targeted facet joint side (No)	Unilateral	22	27.2
	Bilateral	59	72.8

Figure 1. CT-guided facet injection with the needle in the targeted position (arrow).

Figure 2. Axial prone CT scan shows bilateral facet joint injection.

considered statistically significant.

5. Results

All patients enrolled in the study had CT-guided lumbar facet joint infiltration with a total of 81 infiltrated facet joints. Targeted levels for facet joint infiltration including the redo cases were showed in Figure 3.

Using VAS (range from 0 - 10), we sorted the enrolled patients clinically into the following categories: 0: No pain, 1 - 3: Uncomfortable or mild pain, 4 - 7: Dreadful or moderate pain and 8 - 10: Horrible or severe pain.

The collected data were retrospectively reviewed and showed that 82.4% of the patients showed immediate pain improvement within one hour after the procedure reporting no or mild back pain, the percentage increased at 1 month evaluation to be 85.3% and was 67.6% at 12 month follow up. Post procedural all patients were neurologically intact.

21 patients (61.7%) of the total 34 patients mentioned that they experienced

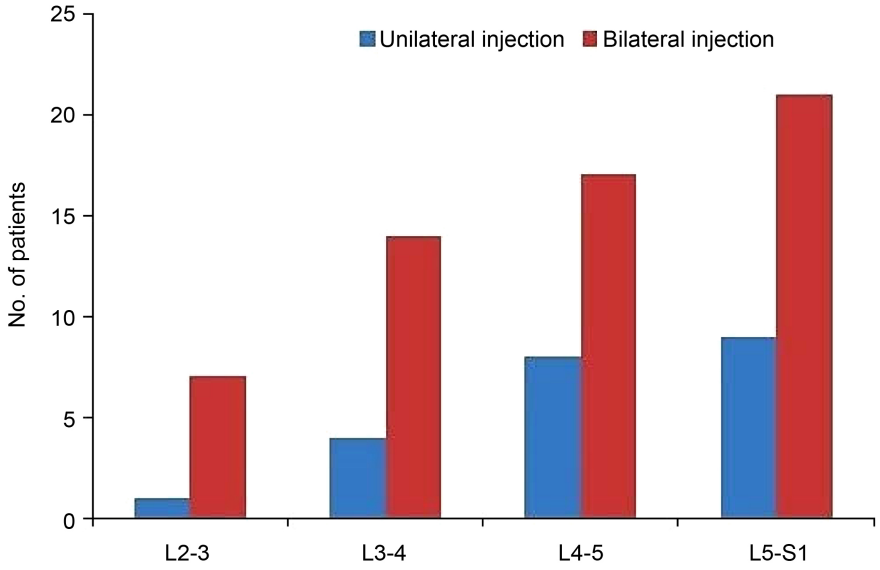

Figure 3. Targeted facet joint levels for injection.

pain relief for almost 6 months and 6 patients (17.6%) reported no pain relief immediately after the procedure. Analysis of patient's clinical outcome is shown in **Table 2**.

Due to recurrence of symptoms or non-improvement, Reinjection was performed to 2 patients (5.8%) at 1 month after the procedure, 5 patients (14.7%) at 3 month but one of them required reinjection again with another six patients at 6 month (**Figure 4**).

6. Discussion

Multiple nonsurgical interventions are currently used for the management of facet joint syndrome. Of these interventions, CT intra-articular facet joint infiltration is considered as an emerging noninvasive modality for diagnosis and management of pain generated by the facet joint where it takes the advantage of better needle visualization with lesser side effects [10] [11].

Radiologically, it is difficult to confirm the diagnosis of facet joint syndrome. Facet arthritis, degeneration or effusion can be seen in different imaging even if the patient has no pain symptoms. We focused on clinical signs eliciting the facet generated pain. Patients enrolled in our study showed localized tenderness on the affected facet joint with deep pressure, back pain exacerbation with hyperextension or lateral bending and diffuse referred pain over the buttock. However, the primarily diagnostic facet joint blocks through CT scanning contributed to confirm the exact pain source and involved facet [12].

Proper intraarticular needle placement can be achieved through fluoroscopic, ultrasonic and CT scan guidance. However, the anatomic obstacles, such as overlying osteophytes, or unclear visualization of the facet joint line on fluoroscopy, make placement of the intraarticular needle extremely difficult. Although the ultrasound guided imaging has lesser radiation to both the patient and the

Table 2. Clinical results of patients (measured by VAS score).

VAS	Preprocedural No. (%)	Immediate Post No. (%)	1 month No. (%)	6 months No. (%)	12 months No. (%)	p value
Mild	0	28 (82.4)	29 (85.3)	21 (61.7)	23 (67.6)	
Moderate	15 (44.1)	4 (11.8)	4 (11.8)	9 (26.5)	8 (23.6)	<0.001
Severe	19 (55.9)	2 (5.8)	1 (2.9)	4 (11.8)	3 (8.8)	

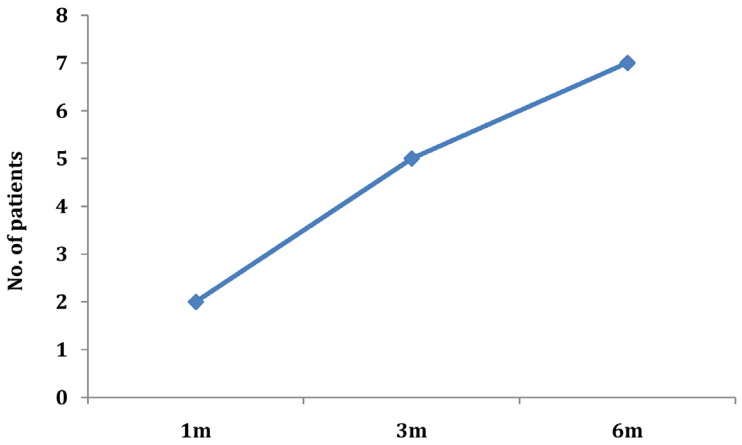

Figure 4. Patients needed facet joint re infiltration.

operating personnel, it cannot be used in obese patients as there is difficulty to properly visualize deep structures [13] [14].

CT scan guidance offers highly anatomic and spatial resolution in the axial plane leading to accessible needle localization [15] [16].

Through an initial low dose scan and obtaining 5-mm axial sections scans on the targeted facets, we were able to localize the skin entry points easily. Desired needle position was obtained using limited intermittent scans in step-and-shoot mode which offered a clear visualization to the joint line. We reported individual variations in facet joint configuration among our patients, so different needle's trajectories were planned based on the obtained CT images. We used slight oblique approach for the needle until it reaches the lip of the facet joint in most of the cases (28 of 34 cases) and straight direction in the rest. Before intraarticular infiltration, the precise needle position was verified by CT scanning thus extremely high accuracy was achieved before the intervention. The steroid used in this study was methylprednisolone acetate which is particulate corticosteroids that have delayed but sustained effect. Long-acting local anesthetic (bupivacaine) was injected intraarticular as well and it achieved immediate pain relief directly after the procedure. The same formula was injected in the series conducted by Arti *et al.* who enrolled 44 patients over a 2-year period, he mentioned that peak effect of the injected the corticosteroid was on the third week after injection [17].

We followed a technique to minimize the radiation exposure. The scans were limited to average length of 6 cm to cover the targeted facet joint only, insertion of both needles at same time in-between the scans in the cases needed bilateral

infiltration and application of fine maneuvers after touching the facet joint to enter the capsule. Markus *et al.* followed a near technique in his study performed on 37 patients. He reported that after 84 lumbar facet joints were injected, the totalamount of used radiation in the procedures was low. He measured the average radiation intensity in the procedure and found that it is less than the accredited reference dose valued by the American College of Radiology for the normalized adults abdominal CT scans by 25% [18].

We didn't report any major complications in our study as we tried to be meticulous in the technique and sterilization. Other researches mentioned that intraarticular facet injection may result in dural puncture, neural trauma, bleeding or infection. These complications rates reach 5% - 10% with fluoroscopy compared to 0.5% rate only with the CT guided injection [19] [20].

In our research, we monitored the response after injection of 81 facet joints. The results showed immediate pain relief after the procedure in 82.3% of patients but the peak was after 1 month as 85.2% of patients showed pain improvement. We believe that proper patient selection and accuracy of the CT scanning contributed to achieve these results. Most of the patients needed reinjection due to non improvement or recurrence of pain after 6 months, 20.5% of the enrolled patients received intraarticular injection. At long term follow up, the percentage of pain relief declined to be 67.6% at 12 month. Near results were obtained by Artiet al after injection of 141 facet joints, significant pain relief was obtained in 81.8% patients 1 hour after the procedure, in 93.3% after 4 weeks and in 85.7% after 12 weeks [17].

We didn't find difficulties in proper patients' selection or locating the facet joint space using the CT scan guidance leading to accurate needle placement. Some limitations were associated with our study as it included small numbers of cases and the high cost of CT device utilization which favors the fluoroscopy facet injection with less expense. Accuracy of CT guided facet joint block was also studied by Weininger *et al.* retrospectively on 37 patients with a total number of 84 facet joint blocks. The study showed that using CT is a safe, rapid and reliable imaging tool with high accuracy for lumbar facet joint block [21].

7. Conclusion

This study showed that CT-guided intra-articular facet joint infiltration provides short and long term pain relief in cases with low back pain. Accessible and accurate needle placement could be achieved through this safe and reliable minimally invasive technique.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Huda, W. and Mettler, F. (2010) Volume CT Dose Index and Dose-Length Product

Displayed during CT: What Good Are They? *Radiology*, **258**, 236-242. https://doi.org/10.1148/radiol.10100297

[2] Datta, S., Lee, M., Falco, F., Bryce, D. and Hayek, S. (2009) Systematic Assessment of Diagnostic Accuracy and Therapeutic Utility of Lumbar Facet Joint Interventions. *Pain Physician*, **12**, 437-460.

[3] vanKleef, M., Vanelderen, P., Cohen, S., Lataster, A., Van Zundert, J. and Mekhail, N. (2010) Pain Originating from the Lumbar Facet Joints. *Pain Practice*, **10**, 459-469. https://doi.org/10.1111/j.1533-2500.2010.00393.x

[4] Galiano, K., Obwegeser, A., Bodner, G., Freund, M., Maurer, H., Kamelger, F., Schatzer, R. and Ploner, F. (2005) Ultrasound Guidance for Facet Joint Injections in the Lumbar Spine: A Computed Tomography-Controlled Feasibility Study. *Anesthesia & Analgesia*, **101**, 579-583. https://doi.org/10.1213/01.ANE.0000158609.64417.93

[5] Sehgal, N., Dunbar, E., Shah, R. and Colson, J. (2007) Systematic Review of Diagnostic Utility of Facet (Zygapophysial) Joint Injections in Chronic Spinal Pain: An Update. *Pain Physician*, **10**, 213-228.

[6] Friedly, J., Comstock, B. and Turner, J. (2014) A Randomized Trial of Epidural Glucocorticoid Injections for Spinal Stenosis. *The New England Journal of Medicine*, **371**, 11-21. https://doi.org/10.1056/NEJMoa1313265

[7] Galiano, K., Obwegeser, A., Bodner, G., Freund, M., Maurer, H., Kamelger, F., Schatzer, R. and Ploner, F. (2005) Real-Time Sonographic Imaging for Periradicular Injections in the Lumbar Spine: A Sonographic Anatomic Study of a New Technique. *Journal of Ultrasound in Medicine*, **24**, 33-38. https://doi.org/10.7863/jum.2005.24.1.33

[8] Schwarzer, A., Wang, S., O'Driscoll, D., Harrington, T., Bogduk, N. and Laurent, R. (1995) The Ability of Computed Tomography to Identify a Painful Zygapophysial Joint in Patients with Chronic Low Back Pain. *Spine* (*Phila Pa* 1976), **20**, 907-912. https://doi.org/10.1097/00007632-199504150-00005

[9] Schauer, D. and Linton, O. (2009) NCRP Report No. 160, Ionizing Radiation Exposure of the Population of the United States, Medical Exposure—Are We Doing Less with More, and Is There a Role for Health Physicists? *Health Physics*, **97**, 1-5. https://doi.org/10.1097/01.HP.0000356672.44380.b7

[10] Sujin, K., Joon, W., Jee, W., Guen, Y., Ja, Y., Heung, S. and Joong, M. (2015) Fluoroscopy-Guided Intra-Articular Facet Joint Steroid Injection for the Management of Low Back Pain: Therapeutic Effectiveness and Arthrographic Pattern. *Journal of the Korean Society of Radiology*, **73**,172-180. https://doi.org/10.3348/jksr.2015.73.3.172

[11] Aguirre, D., Bermudez, S. and Diaz, O. (2005) Spinal CT-Guided Interventional Procedures for Management of Chronic Back Pain. *Journal of Vascular and Interventional Radiology*, **16**, 689-697. https://doi.org/10.1097/01.RVI.0000156193.94573.48

[12] Mannion, A., Balagué, F., Pellisé, F. and Cedraschi, C. (2007) Pain Measurement in Patients with Low Back Pain. *Nature Clinical Practice Rheumatology*, **3**, 610-618. https://doi.org/10.1038/ncprheum0646

[13] Wang, D. (2018) Image Guidance Technologies for Interventional Pain Procedures: Ultrasound, Fluoroscopy, and CT. *Current Pain and Headache Reports*, **22**, 6. https://doi.org/10.1007/s11916-018-0660-1

[14] Wu, T., Zhao, W., Dong, Y., Song, H. and Li, J. (2016) Effectiveness of Ultrasound-Guided versus Fluoroscopy or Computed Tomography Scanning Guidance in Lumbar Facet Joint Injections in Adults with Facet Joint Syndrome: A Me-

ta-Analysis of Controlled Trials. *Archives of Physical Medicine and Rehabilitation*, **97**, 1558-1563. https://doi.org/10.1016/j.apmr.2015.11.013

[15] Lee, J. and Lee, S. (2011) Comparison of Clinical Effectiveness of Cervical Transforaminal Steroid Injection According to Different Radiological Guidances (Carm Fluoroscopy vs. Computed Tomography Fluoroscopy). *Spine Journal*, **11**, 416-423. https://doi.org/10.1016/j.spinee.2011.04.004

[16] Siegenthaler, A., Mlekusch, S., Trelle, S., Schliessbach, J., Curatolo, M. and Eichenberger, U. (2012) Accuracy of Ultrasound-Guided Nerve Blocks of the Cervical Zygapophysial Joints. *Anesthesiology*, **117**, 347-352. https://doi.org/10.1097/ALN.0b013e3182605e11

[17] Arti, C., Sunil, C. and Rajiv, S. (2009) Image-Guided Lumbar Facet Joint Infiltration in Nonradicular Low Back Pain. *The Indian Journal of Radiology and Imaging*, **19**, 29-34. https://doi.org/10.4103/0971-3026.44522

[18] Markus, W., Jared, C., Zoran, R., Giuseppe, B., Walter, H. and Alessandro, C. (2013) Accuracy of CT Guidance of Lumbar Facet Joint Block. *AJR*, **200**, 673-676. https://doi.org/10.2214/AJR.12.8829

[19] Windsor, R., Pinzon, E. and Gore, H. (2000) Complications of Common Selective Spinal Injections: Prevention and Management. *American Journal of Orthopedics*, **29**, 759-770.

[20] Saal, J. (2002) General Principles of Diagnostic Testing as Related to Painful Lumbarspine Disorders. *Spine*, **27**, 2538-2545. https://doi.org/10.1097/00007632-200211150-00027

[21] Weininger, M., Mills, J., Rumboldt, Z., Bonaldi, G., Huda, W. and Cianfoni, A. (2013) Accuracy of CT Guidance of Lumbar Facet Joint Block. *American Journal of Roentgenology*, **200**, 673-676. https://doi.org/10.2214/AJR.12.8829