Comparative study between fluoroscopy guided lumbar facet joint injection versus ultrasound guided injection in patients with low back pain due to facet syndrome

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Abstract: Background of this study was to compare between fluoroscopic guided lumbar facet joint injection versus ultrasound guided injection in patients with facet syndrome. Facet joint pain is characterized by back pain and paraspinal tenderness, associated with groin and thigh pain not extending beyond the knee, and increase with spine extension and rotation. Injections are usually administered under fluoroscopy. ultrasonography is a portable imaging modality with moderate cost which is not associated with radiation exposure. **Methods**: Eighty patients with low back pain admitted for lumbar facet joint injection were randomly divided into two equal groups; fluoroscopic guided facet joint injection group (group 1) and ultrasonic guided facet joint injection group (group 2). Both groups received intra-articular injection of with a mixture containing 0.5 ml of 0.25 % bupivacaine and 0.5 ml (20mg) methylprednisolone acetate (Depo-Medrol; Pfizer). **Result:** Visual Analogue Score and Oswestry disability index significantly improved after injection in both groups in comparison with pre- injection scores. The duration of injection in fluoroscopic guided group was shorter than the ultrasound guided group (p=0.003). There was higher success rate in fluoroscopic guided group (p=0.021**)**. There were no statistically significant differences in the incidence of complications between both groups (p=0.5**)**. **Conclusion:** Ultrasonography guided facet joint injection is feasible and effective method for pain relief in comparison with fluoroscopy guided facet joint injection for patients with lumbar facet syndrome.

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Key words: Low back pain, ultrasound, facet syndrome, facet joint injection

Introduction:

Facet pain means buttock pain, pain in the posterior thigh or inguinal area, tenderness of paravertebral regions corresponding to facet joints, and aggravation of pain from maneuvers that exert maximum irritation on the joints, or from transitional movements. Facet syndrome is diagnosed by clinical characteristics and by excluding other causes of lower back pain (Hellsing, 2000). The facet joints are paired articulations located between the posterior elements of the adjacent vertebrae. They are formed by the articulation of the inferior articular processes of one vertebra with the superior articular processes of the vertebra below (Kranz,2017). The treatment for those with mild to moderate pain is conservative, with the use of acetaminophen, NSAIDs, skeletal muscle relaxants, physical therapy, and restoration of activity and function (Van Kleef,2010). Facet joint interventions may be considered in patients with 3 months of persistent non radicular axial spine pain, resulting in functional disability and not responding to conservative medical management or physical therapy (Manchikanti, 2009). Injections are usually administered under fluoroscopy (FS) guidance to ensure success with the least incidence of complications. Ultrasonography (US) is a portable, moderately priced imaging modality which is not associated with radiation exposure. In recent years, the application of US has increased to diagnose and treat the musculoskeletal system. The study aims to compare preliminary the facet joint injection under guidance of FS or US in patients with low back pain due to facet joint syndrome.

Methodology:

After approval from institutional ethics committee, a prospective randomized study was carried out in Tanta University Hospital. An informed consent was taken from each patient with explanation of the procedure, side effects and complications. All data of patients were coded with secret codes and private file for each patient. The photos were only applied to the parts of body linked to the research and research results were only used for scientific purposes.

Eighty three patients were assessed for eligibility (Figure 1). Included patients were more than eighteen years old, with pain associated with lumbar hyper-extension, lateral flexion, and tenderness on paravertebral regions corresponding to facet joints with normal findings on the straight leg raise test and neurologic examination. Exclusion Criteria included patient refusal and lack of consent, local or systemic infection, allergy to steroids or local anesthetics, patients with coagulopathies, evidence of nerve root compression at the expected level on MRI and pregnant patients. 80 patients were eligible for lumbar facet injection for low back pain. Patients were randomly allocated into two equal groups, 40 patients for each group. Group 1 received facet joint injection under fluoroscopic guidance, group 2 received facet joint injection under ultrasound guidance (n =40 patients).

Fluoroscopic guided injection was performed with the patient placed in the prone position with a pillow under the abdomen to correct the lumbar lordosis. The C-arm was placed in a posteroanterior position first to identify the midpoint of the intervertebral space at the target level. The x ray tube was then slowly rotated till the joint appear in profile as two parallel lines. In a sterile field and administration of local anesthesia, a22-g spinal needle was inserted in line with x-ray beam till bony contact was felt. Placement was confirmed with a posteroanterior, oblique, and lateral view. After bony contact was made, the spinal needle was withdrawn and repositioned superiorly, aimed at the facet joint. The spinal needle then readvanced until it enters the target joint. The stylet was removed from the spinal needle, and the hub was examined for blood or cerebrospinal fluid. If neither was present, gentle aspiration of the needle was carried out. If the aspiration results are negative, the facet joint was infiltrated with a mixture containing 0.5 ml of 0.25 % bupivacaine and 0.5 ml (20mg) methylprednisolone acetate slowly injected into the joint (Figure2).

For Ultrasound guided injection, the patient was placed in the prone position with a pillow under the abdomen to correct the lumbar lordosis. To obtain a paramedian sagittal transverse process image by placing a 2-5-mhz low-frequency curvilinear probe high resolution Ultrasonography (Philips Cx 50 extreme edition) in the longitudinal plane 3 to 4 cm lateral to the middle of the spinous processes at the level to be blocked. An ultrasound survey is taken, and the transducer is slowly moved medially and laterally until successive transverse processes are visualized. The transverse processes of the lumbar spine will appear as hyper-echoic domes with sausage-like acoustic shadows beneath them. After the transverse processes are identifed in the paramedian sagittal transverse process view, the ultrasound transducer is slowly slid toward the midline until the superior and inferior articular facets are visualized. In longitudinal paramedian ultrasound articular process image, the superior and inferior articular facets will appear as successive hyperechoic hills and valleys, with each hill representing a facet joint. After the articular facets are identifed, the skin beneath and below the ultrasound transducer is prepared with antiseptic solution and a 22-gauge spinal needle is inserted through the skin just below the inferior aspect of the longitudinally placed ultrasound transducer using an in-plane approach. While an assistant holds and adjusts the ultrasound transducer, the needle is advanced along the cephalad margin of the transverse process under real-time ultrasound guidance in an inferior to superior direction until the needle tip rests within the facet joint. After gentle aspiration, facet joint was infiltrated with a mixture containing 0.5 ml of 0.25 % bupivacaine and 0.5 ml (20mg) methylprednisolone acetate slowly injected into the joint. During the injection, hypoechoic distension of facet joint was observed. (Figure3)

Primary outcome included the procedure duration (minutes) (the duration from time at which the images were obtained and extending to that time at which injection of the drugs in the spinal needle was completed) and success rate of both techniques. Secondary outcomes included Visual Analogue Scale (VAS) score (Before injections and at 1hour, a week, a month, and three months after injections), Oswestry disability index. (ODI) (Before injections and at a week, a month, and three months after injections) and the incidence of complications such as tingling sensation, allergic reaction.

Results:

Eighty three patients were assessed for eligibility two patients not meeting the inclusion criteria and one patient refused to participate. Eighty patients admitted for lumbar facet injection for low back pain. Patients were randomly allocated into two groups, forty patients for each group.

The demographic criteria for both groups were comparable as regard age, gender and BMI. In group I, 15 patients (37.5%) underwent unilateral facet joint injection and 25 patients (62.5%) underwent bilateral facet joint injection. In group II, 12 patients (30%) underwent unilateral facet joint injection, and 28 patients (70%) underwent bilateral facet joint injection. (P= 0.318). (Table 1)

In group I, the duration required to accomplish fluoroscopic guided facet injection ranged between 13-18 minutes with mean value of 15.5 (±1.4) min. In group II, the duration required to accomplish ultrasonic guided facet injection ranged between 20-27

minutes with mean value of 23.2 (±1.9) min. There was a significant lower duration required to accomplish the procedures in the fluoroscopic guided group (P = 0.003). Procedure success occurred in 40 (100%) patients in group 1 and 35 (87.5%) patients in group 2. Ultrasound guided injection failed in five obese cases where a difficult visualization of the facet joint by a high quality image could not be obtained. In those cases, fluoroscopy was used for guidance of injection with a higher success rate in group 1 (P = 0.21). (Table 2)

VAS before injection ranged between 5-8 and 5-9 in group 1and group 2 respectively (P = 0.178). After 1 hour of injection, VAS in group ranged between 2-3 while in group 2 was 1-5 (P = 0.670). After 1 week VAS in group 1ranged between 2-3 while in group 2 was 1-5 (P = 0.191). VAS after1 month in group 1ranged between 1-4 while in group 2 was 1-5 (P =0.73) and after 3 months VAS in group 1ranged between 1-5 while in group 2 was 1-5 (P =0.10). (Table 3)

ODI in both groups before injection was 26-49 and 28-41 in group1 and group 2 respectively (P =0.092). ODI after 1 week ranged between 16-34 in group 1 and 18-30 in group 2 (P =0.298), ODI after 1 month ranged between 15-27 in group 1 and 16-27 in group 2 (P =0.811). After 3 months ODI in group 1 ranged between 18-37 while in group 2 was 18-26 (P =0.111). Table (4)

In group 1, procedure complications occurred in 7 patients (17.5%), including; tingling sensation in 5 cases (12.5%), allergic reaction in 2 cases (5%). In group 2, procedure Complications occurred in 8 patients (20%), including; tingling sensation in 5 cases (12.5%), allergic reaction in 3 cases (7.5%) (P= 0.5). (Table2)

Discussion:

Facet joint Injections are usually administered under fluoroscopic guidance. However, this technique includes an exposure to ionizing radiation for both the patient and the therapist, and can only be performed in a special theater. In contrast, ultrasonography is a portable, moderately priced imaging modality which is not associated with radiation exposure and can be performed in outpatient clinic. Fluoroscopy shows bone structure, but cannot show the adjacent building. Ultrasound-guided techniques that show the communications between anatomical structures, may improve the accuracy of the procedure (Yun,2012). The aim of this study was to compare the efficacy of fluoroscopy guided lumbar facet joint injection versus ultrasound guided injection in patients with low back pain due to facet syndrome. We performed injection of facet joints at levels L3-L4, L4-L5, L5-S1 either unilateral or bilateral and there was no significant difference between both groups. The duration of injection in fluoroscopic guided group was shorter than the ultrasound guided group. There was higher success rate in fluoroscopic guided group. In case of Ultrasound guided facet joint injection failure, Fluoroscopic guided injection was used to complete the procedure. A possible cause of Ultrasound guided facet joint injection failure is that in obese patients, there was a great gap between the skin and the facet joint. Ha, et al reported that there is a limitation that a high-quality ultrasonographic image cannot always be obtained in case of obese patient which poses a difficulty in obtaining a high-quality image (Ha,2010). Yun, et al (Yun,2012) reported that the success rate of Fluoroscopic guided facet joint injection was 100%. Other study by Galiano, et al showed that in 80% of patients, the facet joints were clearly visible by ultrasound which was confirmed to be performed correctly by CT (Galiano,2007).

There were no statistically significant differences in the incidence of complications between fluoroscopic guided group and ultrasound guided group.

The duration of injection under sonographic guidance was longer than the duration of injection under fluoroscopic guidance in the present study. A possible cause of this difference is that the present study represent the earliest experience in ultrasound guided facet joint injection.

In the study by Ha, et al reported shotrer procedure durations in which the mean injection time in ultrasound guided group was significantly longer than the mean injection time in fluoroscopic guided group (Ha,2010). Moreover, Yun, et al revealed a significant lower procedure duration observed for the Fluoroscopic guided facet joint injections than US guided injections (Yun,2012).

In the absence of patient obesity, the present study showed that both techniques were effective in pain relief as regarding Visual Analogue Score and Oswestry disability index which significantly improved after injection in both groups in comparison with pre- injection scores. Comparison of change in VAS score before and after injection revealed that there was no statistically significant difference between the 2 groups. Yun, et al, Ha, et al Compared change in VAS score before and after injection of lumbar facet joints between ultrasonography guided and fluoroscopy guided groups and reported insignificant difference between both techniques (Yun,2012), (Ha,2010).

As regards the complications in both groups, we found insignificant difference between both groups. In Fluroscopy guided facet joint injection, procedure complications occurred in 7 patients (17.5%), including; tingling sensation in 5 cases (12.5%),

allergic reaction in 2 cases (5%). In Ultrasound guided facet joint injection, procedure Complications occurred in 8 patients (20%), including; tingling sensation in 5 cases (12.5%), allergic reaction in 3 cases (7.5%). A similar result was concluded by Ha, et al who reported that there was no statistically significant differences in the incidence of complications between the two groups as following; there were some cases in which the aggravation of low back pain, a tingling sensation, headache, chest pain and allergic reaction occurred (Ha,2010). In the study performed by Motawea et al reported complications as dural puncture, hematoma formation, spinal cord or neural trauma, spinal anesthesia, septic arthritis and chemical meningitis. These complications of facet joint infiltrations are related to improper needle placement, bleeding, or infection (Motawea,2015).

The comparison of both groups needs a larger scale of patients with accumulation of a longer experience level in the arm of the ultrasound guided facet joint injection for stratification of the results.

There were some limitations in the study. First, a limitation of our study was to include patients above 18 years with no age limitation and there may be some differences in the anatomy, pain pattern and response to treatment in this wide ranging group. also there was no blinding in the study as the patients undergone two different techniques.

Conclusion:

Ultrasonography provides a feasible guidance option for facet joint injection without hazards of radiation exposure but with lower success rate and prolonged duration than fluoroscopic guided injection.

Tables

Table 1: Basic data for the studied patients:

Variable		Group 1 (40)	Group 2 (40)	P. value
Age	**Range**	30.000 - 57.000	33.000 - 55.000	0.176
	Mean ±SD	45.36 (± 9.72)	40.925 (± 8.68)	
BMI	**Range**	23.30 - 39.600	22.91 -40.220	0.959
	Mean ±SD	28.26±9.8	29.41±8.6	
Gender	**Female**	16 (40%)	17 (42.5%)	0.628
	Male	24 (60%)	23 (57.5%)	
Side of injection	**Unilateral**	**15 (37.5%)**	**12 (30%)**	**0.318**
	Bilateral	**25 (62.5%)**	**28 (70%)**	
Level of injection	**L3-L4**	15 (37.5%)	7 (17.5%)	0.127
	L4-L5	14 (35%)	20 (50%)	
	L5-S1	11 (27.5%)	13 (32.5%)	

Table 2: Procedures outcome:

Variable		Group 1 (40)	Group 2 (40)	P. value
Duration of the procedure	**Mean (±SD)**	15.5 (±1.4)	23.2 (±1.9)	0.003
	Range	13-18	20-27	
Procedure success		**40 (100%)**	**35 (87.5%)**	**0.021**
Complications	**Total number**	**7**	**8**	
	`Tingling sensation	**5 (12.5%)**	**5 (12.5%)**	**0.5**
	Allergic reaction	**2 (5%)**	**3 (7.5%)**	

Table 3: VAS in both groups

	Variable		Group 1 (40)	Group 2 (40)	P. value
VAS	**Before Injection**	**Mean (±SD)**	6.30 (±1.04)	6.65 (±1.25)	0.178
		Range	5-8	5-9	
	After 1hour	**Mean (±SD)**	2.53 (±0.59)	2.45 (±0.93)	0.670
		Range	2-3	1-5	
	After 1 week	**Mean (±SD)**	2.33 (±0.65)	2.93 (±1.15)	0.191
		Range	2-3	1-5	
	After month	**Mean (±SD)**	2.45 (±0.95)	2.38 (±1.01)	0.73
		Range	1-4	1-5	
	After 3 months	**Mean (±SD)**	2.95 (±1.08)	2.33 (±1.02)	0.10
		Range	1-5	1-5	

Table 4: ODI in both groups

	Variable		Group 1 (40)	Group 2 (40)	P. value
ODI	Before Injection	Mean (±SD)	36.75 (±6.40)	34.75 (±3.72)	0.092
		Range	26-49	28-41	
	After 1 week	Mean (±SD)	24.70 (±5,12)	23.68 (±3.4)	0.298
		Range	16-34	18-30	
	After 1 month	Mean (±SD)	20.70 (±3.77)	20.88 (±2.65)	0.811
		Range	15-27	16-27	
	After 3 months	Mean (±SD)	26.70 (±5.4)	25.01 (±2.72)	0.111
		Range	18-37	18-26	

Figures

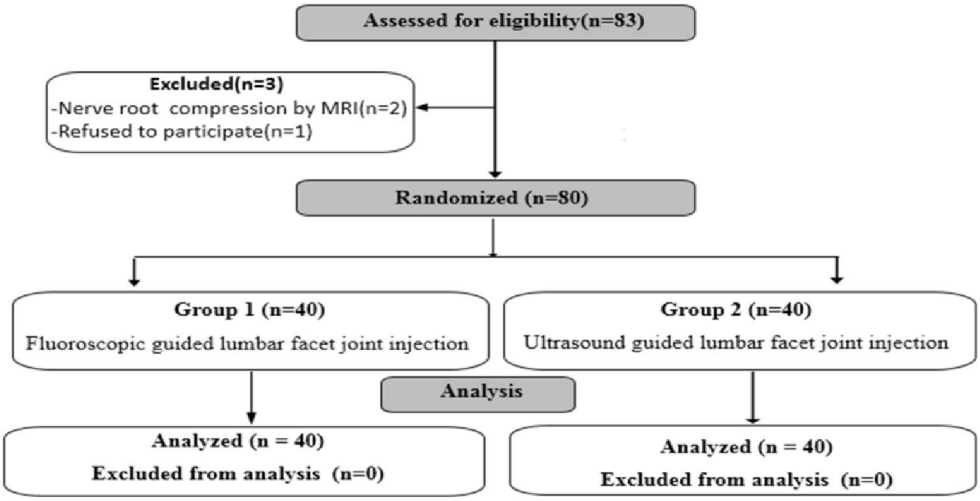

Figure 1: Flow chart of the selected cases

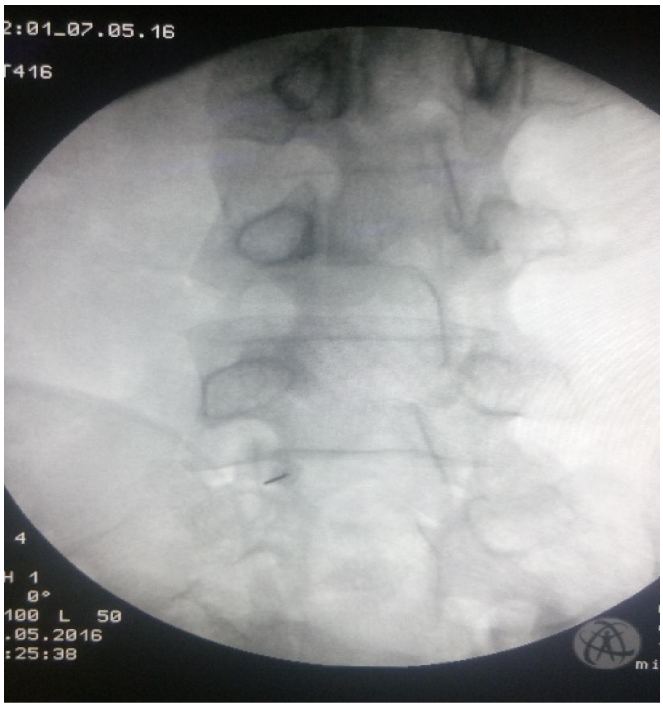

Figure 2: infiltration of facet joint with a mixture containing 0.5 ml of 0.25 % bupivacaine and 0.5 ml (20mg) methylprednisolone acetate

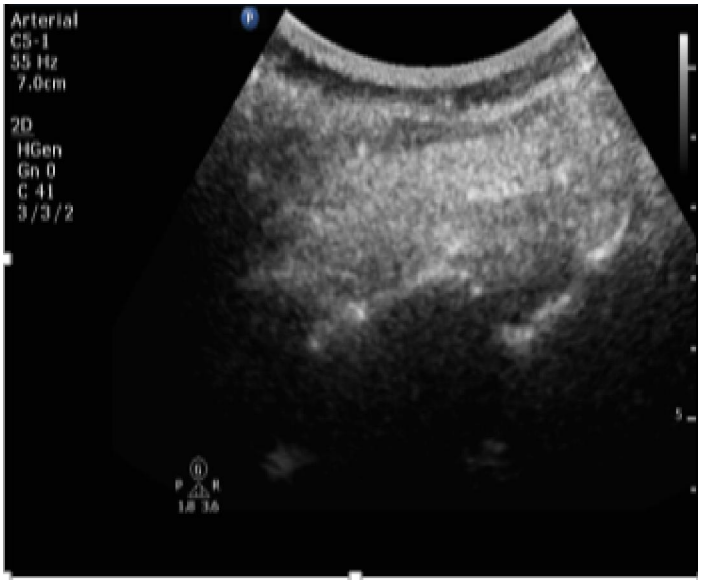

Figure 3: Longitudinal ultrasound image showing the articular processes in the paramedian sagittal articular process view.

Conflict of Interest

Authors declaire that there is no conflict of interest.

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