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ORGINAL ARTICLE

Sacroiliac Joint Pain after Spinal Fusion Surgery; Effectiveness of Sacroiliac Joint Injection

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ABSTRACT

Background: Sacroiliac joint (SIJ) pain after spinal surgery is a common problem. The aim of this study is to report the frequency of new-onset SIJ pain after spinal fusion surgery and to evaluate the response to intra-articular SIJ injection.

Subjects and methods: This is a prospective study including a total of 41 patients who had lumbar or lumbosacral fixation and fusion from June 2017 to December 2018 and developed postoperative SIJ pain that was not responding to conservative treatment and therefore underwent intra-articular SIJ injection. These patients were followed up for six months after injection. Patients were assessed with the visual analogue scale (VAS), the Oswestry Disability Index (ODI) and Odom's criteria.

Results: The mean age was 46.29 ±11.08 years and males presented 53.7%. Thirty-three patients (80.5%) had positive provocative tests and 27 patients (65.9%) had severe pre-injection pain with equal pre-injection VAS and ODI scores. There was a significant improvement in post-injection VAS and ODI scores ($p<0.001$). Excellent Odom's criteria were achieved in younger patients ($p= 0.039$), and in patients with moderate pre-injection VAS/ODI scores ($p<0.001$). Thirty-two patients (78%) had a satisfactory response after three months.

Conclusions: SIJ pain is common following spinal fusion surgery. Good to excellent improvement of disability and pain could be achieved within 3-6 months after intra-articular injection. SIJ Injection could be an effective option to improve the outcomes in patients who failed conservative medical management.

Keywords: sacroiliac joint pain; spinal fusion surgery; Odom's criteria; intra-articular injection.

INTRODUCTION

Although clinical outcomes have been improved following spinal fusion surgeries when performed in carefully selected patients, symptoms related to failed back surgery syndrome reach up to 40% [1].

The sacroiliac joint (SIJ) which is the largest axial joint in the body, forms the most caudal part of the spinal axis. The body weight distribution and the movement across the joint is minimal [1,2]. The SIJ and its ligaments have very rich neural supply, therefore, slight motion increase might trigger pain [2,3]. SIJ related pain is a possible cause of persistent postoperative pain in post spinal fusion surgery patients, so it is important to determine the risk factors for either persisting or newly-onset symptomatic SIJ pain in these patients to improve the postoperative outcome rather than including

these patients within the syndrome of "failed back surgery" [4].

After lumbar fusion surgeries, the motion stresses increase across the SIJ articular surfaces [5]. Biomechanical studies have showed a similar mechanical response in the SIJ and the proximal mobile segments adjacent to a fused spine [5]. The post spinal fusion back pain was related to SIJ dysfunction in 32–42% of the patients. However, the relevance of postoperative SIJ pain after spinal fusion remains unsettled [6].

Aim of the work: The aim of this study is to detect the frequency of new-onset SIJ pain following spinal fusion surgery as well as to evaluate the response to intra-articular SIJ injection.

PATIENTS AND METHODS

Design and patients

This is a prospective study that was conducted on adult patients (≥ 18 years), who underwent lumbar or lumbosacral fixation and fusion surgery at Zagazig University Hospitals during the period between June 2017 and December 2018. Two hundred patients were recruited and followed up for six months after surgery. 92 patients (46%) had developed sacroiliac joint dysfunction (SIJD) and consequent sacroiliac pain. These patients underwent conservative management of their pain (using NSAIDs and physiotherapy). Fifty-one patients (55.4%) responded to treatment. A total of 41 patients with sacroiliac pain did not respond to conservative treatment (in the form of persistent disabling pain) and underwent intra-articular SIJ injection and were followed up for six months after injection **(Figure 1).**

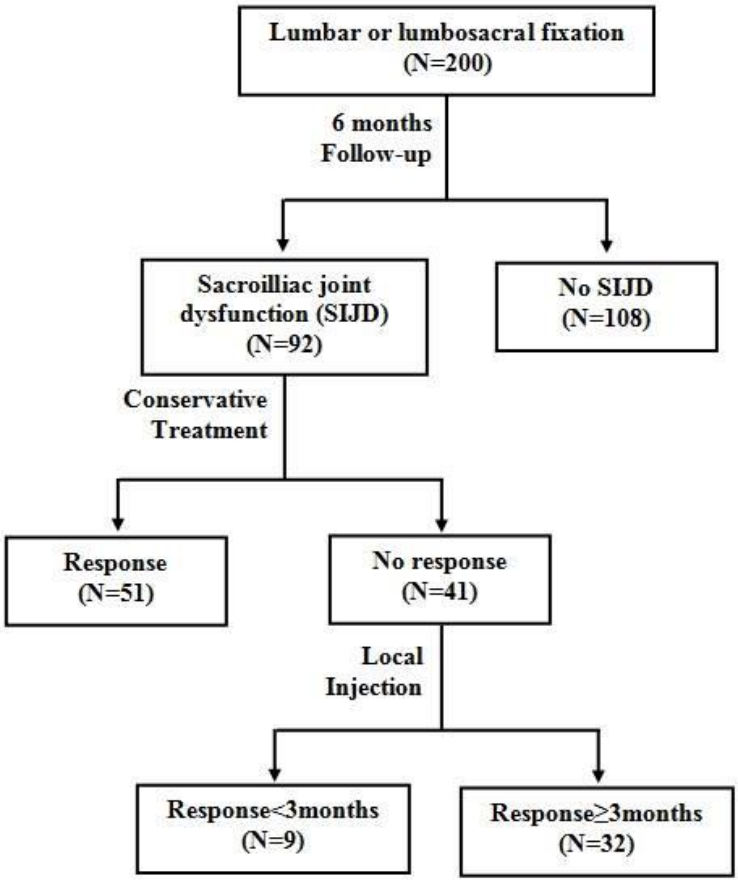

Figure (1): Flow chart of the study.

Ethical consideration

The study was approved by the Local Ethical Committee and written informed consent was obtained from all participants. The study was done according to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Protocol of injection

Setup

Intra-articular SIJ injection was performed under fluoroscopic C-arm guidance, and aseptic technique using sterile gloves, drapes and betadine scrub. We utilized a local anesthetic agent (5 ml of 2% lidocaine per site) for anaesthetizing the skin, a corticosteroid (1 ml containing 40 mg methylprednisolone) plus 1 ml of bupivacaine 0.5% for intra-articular joint injection, and a contrast agent (0.5-1 ml of Iohexol) for delineation of the joint. A styletted, 5-inch, 25-gauge spinal needle was used for the injection. In cases with degenerated and sclerotic joints, a 22-gauge needle was utilized instead [7].

Staff

The Physician, scrub nurse and C-arm technician were present. Staff members were familiar with the technique and its potential complications.

Preparation

An informed consent was obtained after explaining to the patient the benefits, possible outcome and the potential complications. WHO checklist [8] was verified with patient identification and time out. The patient was positioned prone, the surgical site was marked, and the SIJ was verified with image guidance.

Technique

Fluoroscopic guidance:

Following the International Spine Intervention Society (ISIS) guidelines [7], the patient was positioned prone with a pillow below the abdomen at the level of the iliac crests. C-arm was positioned to obtain an anteroposterior (AP) view of the inferior portion of the SIJ with slight medial or lateral tilting with oblique views till the ideal image was obtained at which the bony edges of the inferior articular surfaces were parallel to each other.

The marked area was sterilized and draped, and the local anesthetic agent was used for skin infiltration. Under fluoroscopic guidance, the spinal needle was introduced and advanced towards the inferior part of the SI joint. A popping sensation was felt confirming the desired position. The contrast agent was injected into the joint. The needle placement was finally confirmed after the contrast delineate the joint. A maximum volume of 2.5-3 ml of injectable agents or extracapsular escape determined the endpoint of the injection [7].

Study data and outcomes

After detailed history taking, SIJD was diagnosed clinically (by physical examination of the lower back, pelvis and hips), by provocative tests (including Patrick's, thigh thrust and Gaenslen's tests) and radiologically (using CT and MRI scans).

Baseline characteristics including age, gender and body mass index (BMI) were obtained. Level of fixation, pain level and severity were reported. Before injection; severity of pain was assessed with the visual analogue scale (VAS) [9], and the Oswestry Disability Index (ODI) [10] was used to assess the disability caused by either low back pain or referred pain. After injection; patients were assessed using VAS, ODI and Odom's criteria [11] to assess the outcome. For descriptive purposes, VAS was categorized into scores; zero as no pain, ≤3.4 as mild pain, 3.5 to 7.4 as moderate pain, ≥7.5 as severe pain and very severe pain as 10 [12]. Also ODI was categorized into scores 0% –20%: Minimal disability, 21%–40%: Moderate Disability, 41%–60%: Severe Disability, 61%–80%: Crippled and 81%–100%: bed-bound. [10]

Statistical analysis

Categorical variables were expressed as a number (percentage) and continuous variables were represented as mean ± standard deviation (SD) and median (range). Shapiro-Wilk test was used to check for normality of continuous variables. To compare two groups of non-normally distributed variables, Mann Whitney U test was used. Percent of categorical variables were compared using Pearson's Chi-square test

or Fisher's exact test when was appropriate. Trend of change in the distribution of relative frequencies between ordinal data was compared using Chi-square test for trend. Stuart–Maxwell test (different generalization of McNemar test) was used for testing marginal homogeneity in a square table with more than two rows/columns with using a non-conservative test if needed. All tests were double sided. A p-value <0.05 was considered significant. All statistics were performed using SPSS 22.0 for windows (SPSS Inc., Armonk, NY, USA) and MedCalc windows (MedCalc Software bvba 13, Ostend, Belgium).

RESULTS

Basic characteristics and outcomes

Among the 41 patients who underwent injection; the mean age was 46.29 ±11.08 years and males presented 53.7%. Thirty-three patients (80.5%) had positive provocative tests. Thirty-two patients (78%) had response at or after three months. **(Table 1)**

Change in VAS and ODI

There was a significant change in VAS and ODI scores after injection. Fourteen patients (34.1%) had no post-injection pain while 65.9% had mild pain. Regarding post-injection ODI, all patients had minimal disability. **(Table 2)**

Relation between basic characteristics and post-injection Odom's criteria

Among the basic characteristics; the age of patients, pain distribution, provocative tests, level of fixation and pre-injection VAS/ODI were associated with changes in Odom's criteria. **(Table 3)**

Relation between basic characteristics and duration of post-injection response

Among the basic characteristics, level of fixation was correlated with the duration of post-injection response. **(Table 4)**

Table (1): Basic characteristics and outcome of 41 patients with SIJ pain who underwent injection.

Basic characteristics and Outcome	All patients (N=41)	
	No.	%
Sex		
Male	22	53.7%
Female	19	46.3%
Age		
Mean±SD	46.29 ±11.08	
Median (Range)	49 (20 – 63)	
≤40 years	15	36.6%
>40 years	26	63.4%
BMI		
Overweight	15	36.6%
Obese	26	63.4%
Smoking		
No	29	70.7%
Yes	12	29.3%
Previous L/LS surgery		
No	18	43.9%
Yes	23	56.1%
Pain distribution		
LBP	12	29.3%
LBP & distal pain	29	70.7%

Basic characteristics and Outcome	All patients (N=41)	
	No.	%
Provocative test		
Negative	8	19.5%
Positive	33	80.5%
Level of fixation		
Lumbar, 2 levels	5	12.2%
Lumbar, >2 levels	2	4.9%
Lumbar/Sacral, 2 levels	6	14.6%
Lumbar/Sacral, >2 levels	28	68.3%
Response		
<3months	9	22%
≥3months	32	78%

L: lumbar. S: sacral. LBP: low back pain
Categorical variables were expressed as number (percentage).
Continuous variables were expressed as mean ± SD & median (range).

Table (2): Change in VAS and ODI among 41 patients with SIJ pain who underwent injection.

Pre-injection VAS	Post-injection VAS				Total		p-value§
	No pain		Mild pain				
	No.	%	No.	%	No.	%	
Moderate pain	13	31.7%	1	2.4%	14	34.1%	**<0.001**
Severe pain	1	2.4%	26	63.4%	27	65.9%	
Total	14	34.1%	27	65.9%	41	100%	
Pre-injection ODI	**Post-injection ODI**				**Total**		**p-value§**
			Minimal disability				
			No.	%	No.	%	
Moderate disability			14	34.1%	14	34.1%	**<0.001**
Severe disability			27	65.9%	27	65.9%	
Total			41	100%	41	100%	

VAS: visual analogue scale, ODI: Oswestry disability index
Categorical variables were expressed as number (percentage); § Stuart-Maxwell test; $p<0.05$ is significant.

Table (3): Relation between basic characteristics and post-injection Odom's criteria.

Basic characteristics	All Patients (N=41)		Post-injection Odom's criteria Good (N=27)		Excellent (N=14)		p-value
	No.	%	No.	%	No.	%	
Sex							0.747‡
Male	22	53.7%	14	63.6%	8	36.4%	
Female	19	46.3%	13	68.4%	6	31.6%	
Age							
Mean±SD	46.29 ±11.08		49.56 ±8.94		40±12.37		**0.039•**
Median (Range)	49 (20 – 63)		50 (35 – 63)		39.50 (20 – 58)		

Basic characteristics	All Patients (N=41)		Post-injection Odom's criteria Good (N=27)		Excellent (N=14)		p-value
	No.	%	No.	%	No.	%	
≤40 years	15	36.6%	6	40%	9	60%	**0.008‡**
>40 years	26	63.4%	21	80.8%	5	19.2%	
BMI							
Overweight	15	36.6%	10	66.7%	5	33.3%	0.934‡
Obese	26	63.4%	17	65.4%	9	34.6%	
Smoking							
No	29	70.7%	19	65.5%	10	34.5%	1.000‡
Yes	12	29.3%	8	66.7%	4	33.3%	
Previous L/LS surgery							
No	18	43.9%	11	61.1%	7	38.9%	0.571‡
Yes	23	56.1%	16	69.6%	7	30.4%	
Pain distribution							
LBP	12	29.3%	2	16.7%	10	83.3%	**<0.001‡**
LBP & distal pain	29	70.7%	25	86.2%	4	13.8%	
Provocative tests							
Negative	8	19.5%	1	12.5%	7	87.5%	**<0.001‡**
Positive	33	80.5%	26	78.8%	7	21.2%	
Level of fixation							**0.042§**
Lumbar, 2 levels	5	12.2%	0	0%	5	100%	
Lumbar, >2 levels	2	4.9%	2	100%	0	0%	
Lumbar/Sacral, 2 levels	6	14.6%	6	100%	0	0%	
Lumbar/Sacral, >2 levels	28	68.3%	19	67.9%	9	32.1%	
Pre-injection VAS/ODI							
Moderate	14	34.1%	1	7.1%	13	92.9%	**<0.001‡**
Severe	27	65.9%	26	96.3%	1	3.7%	

BMI: body mass index. L: lumbar. S: sacral. LBP: low back pain. VAS: visual analogue scale. ODI: Oswestry disability index

Categorical variables were expressed as number (percentage); • Mann Whitney U test; ‡ Chi-square test; § Chi-square test for trend; $p<0.05$ is significant.

Table (4): Relation between basic characteristics and duration of post-injection response.

Basic characteristics	All patients (N=41)		Post-injection Response <3months (N=9)		≥3months (N=32)		p-value
	No.	%	No.	%	No.	%	
Sex							
Male	22	53.7%	5	22.7%	17	77.3%	1.000‡
Female	10	46.3%	4	21.1%	15	78.9%	
Age							
Mean±SD	46.29 ± 11.08		47.89 ± 10.94		45.84 ± 11.25		0.825•
Median (Range)	49 (20 – 63)		49 (35– 63)		49 (20– 62)		
≤40 years	15	36.6%	3	20%	12	80%	1.000‡
>40 years	26	63.4%	6	23.1%	20	76.9%	

Basic characteristics	All patients (N=41)		Post-injection Response <3months (N=9)		≥3months (N=32)		p-value
	No.	%	No.	%	No.	%	
BMI							
Overweight	15	36.6%	5	33.3%	10	66.7%	0.248‡
Obese	26	63.4%	4	15.4%	22	84.6%	
Smoking							
No	29	70.7%	6	20.7%	23	79.3%	1.000‡
Yes	12	29.3%	3	25%	9	75%	
Previous L/LS surgery							
No	18	43.9%	5	27.8%	13	72.2%	0.471‡
Yes	23	56.1%	4	17.4%	19	82.6%	
Pain distribution							
LBP	12	29.3%	1	8.3%	11	91.7%	0.240‡
LBP & distal pain	29	70.7%	8	27.6%	21	72.4%	
Provocative tests							
Negative	8	19.5%	1	12.5%	7	87.5%	0.659‡
Positive	33	80.5%	8	24.2%	25	75.8%	
Level of fixation							
Lumbar, 2 levels	5	12.2%	0	0%	5	100%	**0.048§**
Lumbar, >2 levels	2	4.9%	0	0%	2	100%	
Lumbar/Sacral, 2 levels	6	14.6%	0	0%	6	100%	
Lumbar/Sacral, >2 levels	28	68.3%	9	32.1%	19	67.9%	
Pre-injection VAS/ODI							
Moderate	14	34.1%	1	7.1%	13	92.9%	0.131‡
Severe	27	65.9%	8	29.6%	19	70.4%	

BMI: body mass index. L: lumbar. S: sacral. LBP: low back pain. VAS: visual analogue scale. ODI: Oswestry disability index

Categorical variables were expressed as number (percentage); • Mann Whitney U test; ‡ Chi-square test; § Chi-square test for trend; $p<0.05$ is significant.

DISCUSSION

SIJ pain following spinal fusion surgery is associated with worse outcomes and its incidence ranges from 16.2% to 43% [6,13,14]. In our study, 46% of patients had developed SIJD and consequent pain. **Unoki et al.** found an incidence of SIJ pain of 42.4% [15], which is nearly as high as that reported by **DePalma et al.** (43%) [6].

In our study, the postoperative observation period was six months. However, higher rates reported in other studies could be due to longer observation period which was associated with a higher percentage of adjacent segment disease (ASD) and proximal junctional kyphosis (PJK). **DePalma et al.** [6] found that 12 out of 28 cases (43%) has symptomatic SIJ pain; two cases had fusion to L5 while ten cases had fusion to the sacrum. In our study 34 out of 41 cases had fusion to S1 with an increased incidence of SIJ pain with sacral fusion. On the other hand, **Lee et al.** [16] found no increase in the frequency of new-onset SIJ pain in surgeries extending to the sacrum or long segment construction.

SIJ pain not responsive to conservative management is usually managed with intra-articular injections with steroids +/- local

anesthetics. There are few studies that have investigated the results of injection as a treatment in contrary to diagnostic injections [17]. The response to injection has an acceptable success rate as reported by **Liliang et al.** [18] who observed pain reduction greater than 50% in 66.7 % (26/39) of patients for more than six weeks after SIJ injection. In the same study, SIJ injection worked in 5/12 patients with history of lumbar /lumbosacral fusion but with shorter duration of efficacy. In our study 78% (32/41) showed satisfactory pain improvement after three months.

The effect of fusion on the outcome after injection is debatable. **Hart et al.** conducted a study on 14 patients; ten of them involving the sacrum, and found that the results in patients with fusion were good [19].

In our study, excellent post-injection Odom's criteria were achieved in single level lumbar fixation compared to multiple levels, and only nine patients out of 34 had excellent response in the lumbosacral fusion group.

Most diagnostic tests for SIJ pain are not reliable. However, provocation tests were found to have high reliability and validity for diagnosing SIJD [20]. In our study, patients with positive provocation tests had good post-injection Odom's criteria. Excellent Odom's criteria were achieved in younger patients ($p= 0.039$), and in patients with moderate pre-injection VAS/ODI scores ($p<0.001$).

The study has some limitations including the limited number of patients, short follow up period and the single-center experience.

CONCLUSION

SIJ pain is common following spinal fusion surgery. Good to excellent improvement of pain and disability could be achieved within 3-6 months after injection. To improve the outcomes in patients who failed conservative medical management, SIJ Injection could be an effective option.

Conflict of interest: No

Financial disclosure: No

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