

ORIGINAL RESEARCH

PAIN MANAGEMENT

Non-technical factors for recurrence of sacroiliac joint pain after intra-articular steroid injection: a cohort study

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Abstract

Background & Objective: The effectiveness of intra-articular corticosteroid injection therapy is still debatable, despite numerous studies which demonstrated the benefits of steroid injections. Injection failure can be caused by a variety of technical factors, some of which have been identified in studies, including the accuracy with the injection location is performed and the pattern of corticosteroid distribution. We investigated the non-technical factors that influence the effectiveness of intra-articular corticosteroid injection at the sacroiliac joint (SIJ) in the past.

Methodology: It was a prospective cohort study to determine non-technical factors associated with recurrence in patients with SIJ pain who had received multidisciplinary treatment for their ailment. A total of 55 patients met the inclusion and exclusion criteria for the study who were followed up. Patients who had SIJ injections before 9 months and, who had no improvement on the pain scale, or there was a worsening of the pain, or the patient returned with SIJ pain complaints on the same side, were included in the trial. The results were analyzed using logistic regression to determine the likelihood of recurrence.

Results: A total of 55 participants was enrolled in the study, with a higher proportion of females ($n = 33$; 60 %) than males ($n = 22$; 40 %). Thirty-one patients were returning patients (56.36 %) out of 55 patients. According to the results of the bivariate analysis, age was associated with recurrent SIJ pain. According to the results of the T-test, the mean age of the recurrent patients was 49.32 ± 16.68 y, whereas the mean age of the non-recurrent patients was 56.7 ± 12.76 y. The results of the multivariate analysis revealed that age, NSAID consumption, and unilateral SIJ pain, all had protective values in the context of recurrence of the sacroiliac joint pain.

Conclusions: The use of non-steroidal anti-inflammatory drugs (NSAIDs) and the involvement of a single SI joint are protective factors against the recurrence of SI joint pain.

Abbreviations: COST: European Cooperation in Science and Technology; NSAIDs: Non-steroidal anti-inflammatory drugs; SIJ: Sacroiliac joint;

Key words: Anti-inflammatory agent; Non-technical risk factors; Intra-articular; Age; Recurrent sacroiliac joint pain

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1. Introduction

Low back pain is a common neurological symptom that prompts people to seek medical attention.^{1,2} Approximately 5-10% cases of low back pain will progress to chronicity, resulting in diminished quality of

life, disability, and economic burden due to high cost of therapy.¹ The sacroiliac joint (SIJ) is a main location for low back pain, representing 15%–30% of non-radicular low back pain cases.² SIJ discomfort can occur spontaneously or as a result of a traumatic incident, such

Table 1: Demographic variable of respondents

Variables		n	%
Gender	Male	22	40
	Female	33	60
BMI	<18.5	1	1.82
	18.5-24.9	29	52.73
	25-29.9	19	34.55
	≥ 30	6	10.91
Pregnancy history	Yes	26	47.27
	No	29	52.73
Trauma history	Yes	35	63.64
	No	20	36.36
Sitting History	<1 h	12	21.82
	1-2 h	13	23.64
	3-6 h	12	21.82
	>6 h	18	32.73
Prolonged Standing History	Yes	11	20
	No	44	80
Onset of Pain	≥ 3 months	15	27.27
	< 3 months	40	72.73
NSAID use	Yes	9	16.36
	No	46	83.64
History of Knee Pain	Yes	13	23.64
	No	42	76.36
SIJ Pain	Left	20	36.36
	Right	35	63.64
Injection History	Yes	6	10.91
	No	49	89.09
SIJ pain	Recurrent	31	56.36
	Not-Recurrent	24	43.64

as a fall or repeated shear.³ The SIJ can be injured through a variety of intra or extra-articular mechanisms, including

ligamentous strain, muscle inflammation, capsular damage, infection, fracture and arthritis.^{3,4} In addition to the above factors, several comorbid factors can cause sacroiliac joint pain, including spondylitis conditions, especially ankylosing spondylitis, pregnancy due to hypermobility-related hormonal changes and leg-length discrepancies and sacral dysmorphism, associated with the surface of the sacroiliac joint.^{5,6}

SIJ dysfunction causes pain delineated by the posterior superior and posterior inferior iliac spines, as well as discomfort and tenderness in the sacral sulci.⁴ Pain is frequently localized to the posterolateral thigh, buttocks, low lumbar area, and groin, which correlates to the distribution of L4-L5 roots.^{3,4} The International Association for the Study of Pain (IASP) proposes criteria for evaluating patients with suspected SIJ dysfunction: (1) Pain located to the SIJ, (2) reproduced by specific provocative maneuvers, and (3) relieved by injection of a local anesthetic at the SIJ.⁷

Management during the early acute phase generally includes the administration of NSAIDs and physical therapy. NSAIDs work by inhibiting the activity of cyclooxygenase enzymes; these enzymes are involved in the synthesis of prostaglandins, which are involved in inflammation and play a role in anti-nociception.⁸ Intra-articular corticosteroid injection therapy is generally used when initial management fails to resolve pain,⁹ although its effectiveness remains controversial. Several studies have demonstrated the benefits of steroid injections.^{10,11} A systemic review conducted by Hansen et al.¹² showed that the effectiveness of intra-articular steroid injections is poor. This outcome is also emphasized by the European Cooperation in Science and Technology (COST) guideline, which does not recommend SIJ corticosteroid injection due to limited evidence,¹³ on the intra-articular action of corticosteroids. Several studies suggested technical factors, such as accurate location of injection site and cephalad distribution of the injected drug.¹⁴ Research on non-technical factors affecting the effectiveness of intra-articular corticosteroid injection at the SIJ is limited; therefore, we conducted this study aimed to determine non-technical factors causing recurrent SIJ pain after optimal intra-articular corticosteroid injection

2. Methodology

It was a prospective cohort study which measured recurring SIJ pain variables in patients who received comprehensive treatment. Participants were patients diagnosed with SIJ pain according to the IASP, which defines SIJ pain as located to the SIJ area, reproducible with provocative maneuvers and has a 50-70% symptom reduction after local anesthetic is administered into the joint, had intra-articular corticosteroid injections under ultrasound guidance and remain pain-free for 3 days after the procedure. All patients had capacity and gave written consent to participate in the study. Laboratory reports suggestive of infectious arthritis, history of pelvic surgery or trauma and fractures were the exclusion criteria. Patients who could not be reached out for evaluation were also excluded of the study. The ethical committee of Universitas Pelita Harapan's Medical Faculty gave approval for the conduction of this study

Table 2: Mean difference of variable among sacroiliac joint pain patients

Variable	Recurrent			Not-Recurrent			P value
	Mean ± SD	Median	Min/Max	Mean ± SD	Median	Min/Max	
Age (y)	49.3 ± 16.7	50	19/77	56.7 ± 12.7	56	29/84	0.0779*
Weight (kg)	65.8 ± 13.9	62	47/110	64.3 ± 9.5	61.5	49/86	0.9728
Height (cm)	160.7 ± 10.3	160	145/180	159.2 ± 8.3	156.5	145/175	0.7458
BMI (kg/m ²)	25.57 ± 5.35	24.14	17.6/42.4	25.5 ± 4.2	24.49	18.9/40.4	0.6775
NRS score	7.93 ± 1.09	8	6/10*	7.6 ± 0.9	8	6/9*	0.435

*Mann-Whitney U test and * independent t-test analysis*

(170/K-LKJ/ETIK/XI/2020).

A qualified neurologist conducted all clinical assessments. The numerical rating scale (NRS) was used to rate SIJ pain, and was reevaluated 3, 6, and 9 months after treatment. If a patient returned with ipsilateral pain which was evaluated with NRS before 9 months, it was considered as a recurrence. Age, sex, BMI, sitting time per day, history of pregnancy, trauma, long-term standing, NSAIDs use, and knee discomfort were assessed to determine association with SIJ pain recurrence.

Statistical Analyses

The Statistical Package for the Social Sciences (SPSS) version 25 was used for data analysis. The Kolmogorov-Smirnov test was used to determine whether a numerical variable was normal. Mean values, standard deviation, frequencies and percentages for nominal and ordinal variables are descriptive statistics for normally distributed variables. Independent t-test and Mann-Whitney U test were used to examine the mean difference of numerical variables between recurrent and non-recurrent. The results are displayed in Table 1. Binary bivariate and multivariate logistic regression models were used to obtain the odds ratio and 95% confidence interval. If $P \leq 0.5$, the results were significant.

3. Results

Female participants accounted for almost 60% of the total. SIJ pain recurrence affected 31 patients (56.36%). Right SIJ discomfort affected more than half of the patients (n = 35, or 63.64%). N = 40, or 72.73% of patients reported their pain was triggered within the previous three months (Table 1).

Age may be linked to recurrent SIJ discomfort, according to bivariate analysis (Table 2). Patients with and without recurrence had a mean age of 49.32 ± 16.68 years and 56.7 ± 12.76 y, respectively. The difference in the mean of the numeric rating scale before procedure and after follow up was 2.9 ± 0.38 ($P < 0.001$). Table 2 shows that

recurrence of SIJ pain is strongly linked to older age, high BMI, NSAID use, history of knee pain, and unilateral SIJ pain in multivariate analysis.

4. Discussion

Our findings revealed that age is the only component substantially associated in the bivariate analysis; older age is a protective factor against SIJ pain recurrence. This conclusion is intriguing, since joints undergo degenerative changes with age, and this is a well-known risk factor for SIJ pain.

Age, in theory, is a major influence in the recurrence of joint pain, particularly SIJ pain, because the degenerative process can be a persistent pain generator.¹⁵ Ziegeler et al. used CT scan on the SIJ to reveal that older adults have a higher risk of acquiring degenerative lesions like sclerosis, osteophytes, and joint space change.¹⁶

Aging causes collagen in the ligaments to become shorter, stiffer and less elastic, decreased in water content of hyaline cartilage and fibrocartilage which can lead to increased joint stiffness and less elasticity.¹⁷

The SIJ is an axial joint which connects the spine to the pelvis. The relatively flat shape of the SIJ and its ligaments have a role to transfer bending movements and compression loads but does not have as much stability against shear stress.¹⁸

Hammer et al. predicted that SIJ cartilage and ligaments play a significant role in pelvic stability. Decreased pelvic motion is related to stiffness of interosseous, iliolumbar, anterior sacroiliac and posterior sacroiliac ligaments.¹⁹ Literature reports ligament laxity leads to subchondral bone and cartilage changes. Loeser and Shakoore suggested that age related changes in musculoskeletal tissue including ligament laxity may predispose to osteoarthritis.²⁰ Age-related changes in ligaments and joint capsules decrease stiffness raising the possibility for injury. In addition, with increasing age, the rate of ligament and capsule healing tends to decline, and develop degenerative changes.²¹

Joint degeneration occurs in the 20s and tends to progress to severe degeneration at age 40 or older, with multiple degenerative lesions observed in all individuals at 50 years or older, according to studies on the aging process of the SIJ using CT analysis. The discrepancies in our study could be due to several factors, including (1) underreporting pain symptoms by elderly patients compared to younger population who report complaints more often,²² and (2) selection bias, approximately 78.1 % of the subjects in our study were 40 y or older, who were further classified as older age in the multivariate analysis, since joint degeneration is more prominent in that age group. According to a recent study, the diagnosis of SIJ pain with dual comparative local anesthetic block positivity was more frequently identified in the older age group than in the negative group (mean age 53.31 y vs. 46.8 y), hence older patients were sampled.

A multivariate analysis revealed older age, NSAID use, and unilateral SIJ pain were all protective variables for SIJ pain recurrence (OR1, $P < 0.05$). NSAIDs have been proposed as conservative or adjuvant therapy for intra-articular corticosteroid injection in SIJ pain in several studies. The suppression of the cyclooxygenase enzyme (COX), which converts arachidonic acid to thromboxane, prostaglandin, and prostacyclin, is the main mechanism of action of the NSAIDs. These chemicals, in addition to being inflammatory mediator, also have a role in activating nociceptors, which are responsible for pain reactions triggered by the inflammatory process.²³ The link between unilateral involvement and milder SIJ pain severity and non-ankylosing spondylitis as the underlying etiology could explain why unilateral involvement is a protective factor in the recurrence of SIJ pain. Ankylosing spondylitis, one of the most severe spondyloarthropathies, can induce sacroiliitis, which is usually bilateral and symmetrical in 85-90% of the patients, whereas sacroiliitis in other milder spondyloarthropathies is frequently unilateral and asymmetrical.²⁴

Surprisingly, factors related to the onset of SIJ pain were not associated to the recurrence of SIJ pain. Female sex, high BMI, prolonged sitting time, and history of pregnancy were all found to be predisposing factors for SIJ discomfort in a prior study.²⁵ Females are more prone to suffer from severe joint degeneration, including the SIJ. A dominant factor is the sexual dysmorphism of the pelvis. Males tend to have a relatively narrow pelvis, with a longer and more conical shape compared to the female pelvis. These gender differences also reflect in the biomechanics of the joint; the female SIJ has higher mobility, and is subject to more stress load, and pelvis-ligament strains, compared to the male SIJ.¹⁸ Moreover, hormonal instability is also considered, especially during menopause or pregnancy.²⁶ Pregnancy has previously

been linked to SIJ pain, owing to a hormonal surge of relaxin that causes relaxation of the SIJ ligaments, resulting in laxity, asymmetry and biomechanical malfunction.²⁷ High BMI and lengthy periods of sitting might increase the wear and tear process, speeding up the degenerative process.²⁵ The lack of association between these characteristics and pain recurrence could be explained by our study's small sample size and short follow-up period, which was insufficient to identify a recurrence of SIJ pain. Hawkins et al. found that two-thirds of SIJ pain patients who received intra-articular corticosteroid injections experienced considerable relief for up to nine months.²⁸ To assess recurrence in this study, a numeric rating scale was used as data base.

5. Limitation

The limitation of our study is that we did not examine and analyze the technical factors of intra-articular steroid injection, such as drug distribution pattern and accuracy locating the site of injection. We didn't include imaging results, so we couldn't establish association between degenerative or structural lesions in the SIJ and pain recurrence. In conclusion, age, NSAID use, and unilateral SIJ pain involvement are all protective factors against SIJ pain recurrence.

6. conclusion

In conclusion, old age, NSAID use, and unilateral SIJ involvement are all protective factors against SIJ pain recurrence.

7. Data availability

The numerical data generated during this research is available with the authors.

8. Acknowledgments

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9. Conflict of interest

None declared by the authors. The study was self-financed by the authors.

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