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Research Article

Efficacy of Peri-Articular Versus Intra-Articular Sacroiliac Joint Blocks under Fluoroscopy Guidance: A Multicentric Study

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Abstract

Background: Lower back pain is a very common health problem amongst the population and a major cause of disability that affects work performance and wellbeing. Sacroiliac arthritis is a well-known cause of lower back pain. Sacroiliac Joint (SIJ) injections are a known modality of managing acute and chronic SIJ pain. These injections are generally used to diagnose and/or treat patients. There are two potential targets for sacroiliac joint injections; the periarticular (intracapsular) or the intraarticular spaces. The purpose of this study was to compare between these two approaches and their efficacy to relieve pain. Two centers participated in this study; Jordan University Hospital (JUH), Amman, Jordan and HELIOS Dr. Horst Schmidt Kliniken (HSK), Wiesbaden, Germany. Methods. This study involved a total of 96 patients from both centers (45 patients from JUH and 51 from HSK), where they were initially seen in the outpatient departments, clinically diagnosed and divided into two groups according to the side of pain. Those who complained of right sided pain (46 patients) were given intra-articular injections while those who complained of left sided pain (50 patients) were given periarticular injections. The injections contained 1mL of 40mg methylprednisolone acetate with 1 mL of 2% lidocaine. Results. The pain was evaluatedin the 96 patients at multiple intervals of time using the Numerical Rating Scale (NRS-11) as well as Verbal Rating Scale (VRS). Periarticular injections were found to be superior to intraarticular injections when compared directly after the injection (P=0.160 in Jordan, P=0.015 in Germany), one week after the injections (P=0.021 in Jordan verses P=0.001in Germany), one month after the injections (P=0.009 in Jordan verses P=0.00002 in Germany) and three months after the injections (P=0.003 in Jordan verses P=0.0002 in Germany). Conclusions. Periarticular injections were significantly superior in relieving sacroiliac pain in comparison to intraarticular injection; from our study, we recommend the use of periarticular injection in the treatment of SUJ pain. We also recommend further prospective studies needed to confirm our findings.

Keywords: Low back pain; Sacroiliitis; Intra-articular; Peri-articular; Joint block

Introduction

Lower back pain is a prevalent health problem and a significant cause of disability that affects work performance and well-being [1]. It may arise from the Sacroiliac Joint (SIJ) and the lumbar disk, lumbar facet, or hip joint. Sacroiliac arthritis is a well-known cause of lower back pain. Routine investigations and radiological studies are usually not helpful, making the mainstay of diagnosis clinical [2].

Patients typically complain of pain over the buttocks that may extend to the lateral aspect of the hip or thigh [3]. Patients frequently mention the difficulty of rising from bed in the morning and improvement upon further movement. Physical findings are limited to tenderness over the sacroiliac joint. Patrick's test (also known as the FABER test, which stands for flexion, abduction, and external rotation) is performed by having the tested leg flexed, and the thigh abducted and externally rotated. If the patient experiences pain posteriorly on the contralateral side, this suggests Sacroiliitis or SIJ dysfunction [4], which may be seen as age-related degenerative changes on a simple pelvic X-ray of the sacroiliac joint [5]. Inflammatory markers, such as ESR and CRP, might be slightly elevated, yet they are not specific [6].

The treatment of Sacroiliitis remains a therapeutic challenge to this day. Our patients are initially treated conservatively with Non-Steroidal Anti-Inflammatory Agents (NSAIDs) and possibly a short course of oral steroids. Consequently, those patients frequently present with chronic pain due to partially treated pain or incompliance to the long-term therapy [7,8]. However, acute pain is not uncommon in our practice [9]. The pain may be unilateral or bilateral, and there are often limitations of movement, and its severity falls within the spectrum of mild to severe pain that renders the patient immobile and bedridden according to the Numerical Rating Scale (NRS-11) as well as Verbal Rating Scale (VRS) [10].

Sacroiliac joint injections are a known modality of managing acute and chronic SIJ pain. These injections are generally used to diagnose or treat patients with either spondyloarthropathy [11-13] or non-spondyloarthropathy SIJ dysfunction [12,14,15]. The two potential sites for SIJ injections are peri-articular (within the fibrous compartment of the joint) [12,16-18] or intra-articular (within the synovial compartment) [11,12,14,15]. Due to the complex anatomy of this region, injections are often technically challenging, even if assisted by fluoroscopy [17,18], ultrasound [13,16], or magnetic resonance imaging guidance [12]. Although the accuracy of Computed Tomography (CT) - guided SIJ injection approaches is 100% [11], this technique has been criticized as a time-consuming procedure that may increase the radiation exposure risk [12,14,18]. To address these issues, we have adopted a protocol for SIJ injections based on the mobile C-Arm X-Ray fluoroscopy system [8].

Our study aimed to compare these two approaches and their efficacy in relieving pain. Two centers have participated in this study, Jordan University Hospital (JUH), Amman- Jordan, and HELIOS Dr. Horst Schmidt Kliniken, Wiesbaden-Germany. All right-sided SIJ injections were done using the intra-articular approach, whereas all left-sided SIJ injections were done using the peri-articular approach.

Methodology

Study population

This study was carried out in two centres, at JUH and HSK. A total of 101 patients participated in this study; 5 were excluded throughout the study. The remaining 96 patients included 45 patients from JUH and 51 patients from HSK **(Figure 1)** for the duration of 2 years and a half (January 2014 through June 2016).

Patient Demographics

At JUH

1. Twenty-three (n=23) underwent peri-articular injections: 20 were female, and 3 were males, with an average patient's age of (54.91) years, ranging from (27-81).
2. Twenty-two (n=22) underwent intra-articular injection: 19 were females, and 3 were males, with an average patient's age of (61.72) years, ranging from (29-92).

At HSK

1. Twenty-seven (n=27) underwent peri articular injections: 19 were females and 8 were males, with average patient's age of (58.22) years, ranging from (29-79).
2. Twenty-Four (n=24) underwent intra articular injection: 21 were females and 3 were males, with average patient's age of (60.12) years, ranging from (32-79) (**Table 1**).

	JUH	HSK
Total number of patients underwent peri-articular injections	23	27
Number of Females patients underwent peri-articular injections	20	19
Number of Males patients underwent peri-articular injections	3	8
The average patient's age underwent peri-articular injections	54.91 years ranging from (27-81)	58.22 years ranging from (29-79)
Total number of patients underwent intra-articular injections	22	24
Number of Females patients underwent intra-articular injections	19	21
Number of Males patients underwent intra-articular injections	3	3
The average patient's age underwent intra-articular injections	61.72 years ranging from (29-92)	60.12 years ranging from (32-79)

Table 1: The number of patients who underwent peri-articular and intra-articular injections according to their gender and average age.

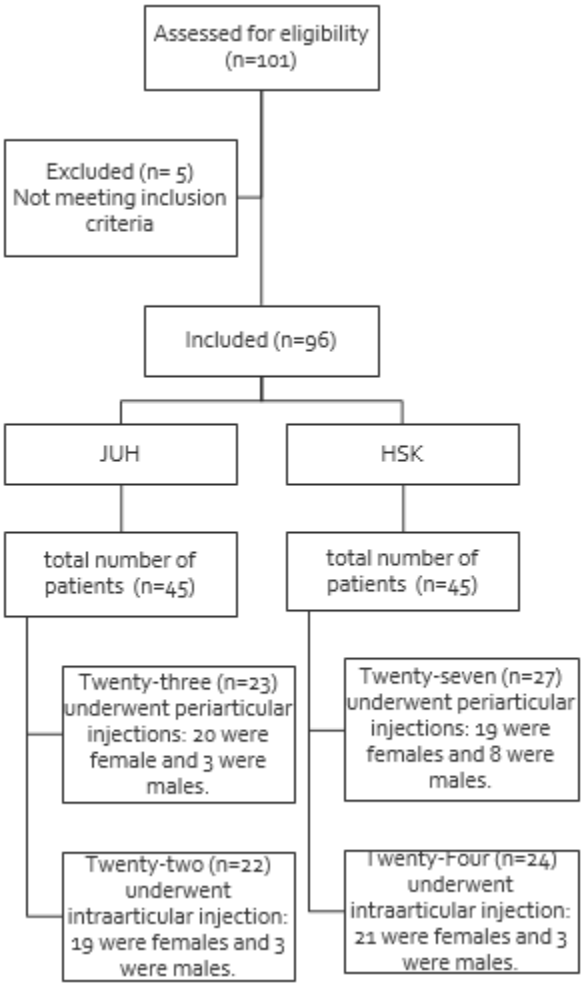

Figure 1: The number of included and excluded patients.

Patients' assessment tools

All patients involved in our study were initially seen in our outpatient departments. They were clinically diagnosed based on their complaints and clinical examination, regardless of radiological findings. Laboratory investigations were not routinely requested. Patients were categorized into right and left Sacroilliitis irrespective of their age and gender, and their pain was evaluated using NRS-11 and VRS. There are three commonly used pain-rating scales (Visual Analog Scale (VAS), NRS-11, VRS) which are valid and reliable for use in clinical practice. However, VAS has more practical difficulties than NRS-11 and VRS, making them more efficient to be used. Furthermore, NRS-11 has good sensitivity and generates data that can be statistically analyzed [10]. Our patients were evaluated by the numeric pain score on a scale of 0-10, 0 (zero) being "No pain" & 10 " Severe pain"(**Table 2**).

0	1	2	3	4	5	6	7	8	9	10
Verbal Descriptive Scale. 0: No pain; 1: Mild pain; 2: Moderate pain; 3: Severe pain										

Table 2: Numerical rating scale.

Interventions

All patients who participated rated their pain a score of 8 and above. Prior to the procedure, informed consent was obtained from the patients. Patients were admitted to the day case department, and procedures took place in the Operative Room (OR) under completely sterile conditions according to WHO guidelines for safe surgery [19]. Patients were situated in the prone position on the operating carbon table, and the back was cleansed, sterilized, and draped. With the x-ray tube perpendicular to the table, Anteroposterior (AP) views were taken to localize the joint and mark the entry point. Prior to the injection, lidocaine was used as a local anaesthetic. For the right intra-articular injection, a lumbar puncture needle of 22-gauge was guided into the centre of the joint under fluoroscopy guidance until the needle penetrated the joint without the use of contrast material.

All right-sided injections were given intra-articular (mostly in the mid-portion of the joint), and fluoroscopy confirmed the aforementioned location. A mixture of 2 ml of 2% lidocaine and 40 mg of methylprednisolone was injected then the needle was withdrawn. The entry point was cleansed with alcohol left to dry, and the wound was covered with an Air Strip.

All left-sided injections were given in the joint capsule (peri-articular), and the same combination of medications aforesaid was injected in three different portions of the capsule; upper, middle, and lower. The needle was withdrawn, and the area was cleaned and covered similarly as described previously.

All patients were asked to step down and were assisted for a few steps to assess their direct post-procedural pain, which was documented according to the pain score. Patients were observed for two hours in the recovery section of the day-case ward and then discharged after assessing their general welfare and deeming them fit for discharge. Patients were maintained on a low-dose Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) (Ibuprofen or diclofenac sodium) till their first follow-up in the outpatient department, which was scheduled one week after the procedure, to document their pain post-procedure. Follow-ups were carried out one and three months as well.

Inclusion and Exclusion criteria

We included healthy patients aged 18 and above (adults and elderly). Patients who were excluded were those we lost for follow-up or those who underwent another surgical procedure for other lower back pain causes, and patients with multiple joint complaints.

Ethical approval

The prospective study was approved by the Ethics Committee, and all patients gave informed consent before participating. Questionnaires were designed in an interview-based manner, and no identifying information was obtained through the questionnaire. Informed consent was attached on the first page of the study's questionnaire and was written in the official language of each country. The consent clarified the aims of the study and emphasized the confidentiality of the given information and the right of the participants to withdraw from the questionnaire at any point.

Statistical analysis

For statistical analysis, we used IBM SPSS Statistics software (version 23.0.0.0, 64-bit edition) for analyzing the collected data (SPSS Inc., Chicago, Illinois, USA). The data was analyzed using Independent-Samples T-Test. The statistical significance for the results in all these two-tailed statistical tests was considered as P-value <0.05 with a 95% confidence interval percentage.

Results

Of the forty-five (n=45) patients who underwent SIJ injections at JUH, twenty-three (n=23) patients underwent peri-articular injections, and twenty-two (n=22) patients underwent intra-articular injections. When comparing the pain scores for the two groups of patients, the mean pain score prior to the injections was 8.74 for patients who underwent peri-articular injections and

8.86 for intra-articular injections.

The successive mean pain scores for the peri-articular injection immediately after the injection, after one week, after one month, and after three months were 3.00, 2.22, 1.91, and 1.65, respectively, and for the intra-articular injection were 4.32, 4.27, 4.59, and 4.73 respectively. (See below)

Of the fifty-one (n=51) patients who underwent SIJ injections at HSK, twenty-seven (n=27) patients underwent peri-articular injections, and twenty-four (n=24) patients underwent intra-articular injections. When comparing the pain scores for the two groups of patients, the mean pain score for the two groups of patients before the injections was 9.3 for patients that underwent peri-articular injections and 9.75 for patients that underwent intra-articular injections. The successive mean pain scores for the peri-articular injections immediately after the injection, after one week, after one month, and after three months were 0.44, 1.26, 0.37, and 0.33, respectively, and for the intra-articular injection, 1.33, 2.25, 2.17, and 2.79 (**Table 3**).

	JUH		HSK	
	Intra-capsular Mean	Intra-articular Mean	Intra-capsular Mean	Intra-articular Mean
Before	8.74	8.86	9.30	9.75
Directly After	3.00	4.32	0.44	1.33
1st Week	2.22	4.27	1.26	2.25
1st Month	1.91	4.59	0.37	2.17
3rd Month	1.65	4.73	0.33	2.79

Table 3: The mean pain score at different time intervals for both JUH and HSK patients.

Discussion

The SIJ is anatomically complex and comprises a fibrous part where the joint surfaces are held together by interosseous ligaments and a cartilaginous part with some synovial joint features [20]. The SIJ is a large, auricular-shaped, diarthrodial synovial joint. Actually, the true synovial joint is only the anterior third of the boundary between the sacrum and Ilium; the rest of the junction consists of a sophisticated set of ligamentous connections. Due to an absent or rudimentary posterior capsule, the SI ligamentous structure is broader dorsally, functioning as a connecting band between the sacrum and Ilium [21].

Two types of injections have been implemented for SIJ pain relief: an injection of local anaesthetic or corticosteroids (or both) into the intra-articular space and the peri-articular region [2,3], in particular into the posterior ligamentous structures [11-16,22]. However, it is still controversial as to which type of injection is more effective. In this study, our aim was to compare the efficacy of peri-articular and intra-articular SIJ injections in regard to pain relief along with multiple time scales: immediately after the injection, after one week, after one month, and after three months.

The improvement from the peri-articular SIJ injections was significantly greater than the intra-articular SIJ injections. This might be explained by the presence of nociceptors and neural innervations in the posterior ligamentous tissues in addition to the joint capsule itself, thus establishing these structures as further contributors of pain due to Sacroilliitis [23-25]. Furthermore, histological studies revealed that the majority of the SIJ is syndesmotic while only the distal third of the SIJ resembles some characteristics of a synovial joint [26]. The clinical efficacy of peri-articular injections is not only due to targeting the synovial part of the SIJ but also the inter-osseous ligaments, which can also be affected during Sacroilliitis as assumed by Wolfgang Hartung, et al. [12].

In the study, a significant improvement with peri-articular injections compared to intra-articular injections was observed directly after the procedures performed at HSK. In contrast, at JUH, significant improvements were detected after the first week of the procedure. Further investigations and analysis may be carried out in trying to explain this discrepancy.

The effect size was reported through Cohen's d Standard, which was calculated for each follow-up separately. Cohen's d was used as a statistical tool to measure the effectiveness of the procedure. The effectiveness was divided into small, medium, and large depending on Cohen's d value, as shown in **Table 4.**

Cohen's Standard	Large			Medium			Small		
Effect Size	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1	0

Table 4: Effect size reported through Cohen's d standard.

The results at JUH showed the effectiveness as small-medium for the immediate period as Cohen's d is more than 0.2 but less than 0.5, while medium to large after one week as Cohen's d is more than 0.5 but less than 0.8, large after one month as Cohen's d value is more than 0.8, and large after three months as Cohen's d value is more than 0.8. On the other hand, the results at HSK showed the effectiveness as medium-large for the immediate period as Cohen's d is more than 0.5 but less than 0.8, large after one week as Cohen's d is more than 0.8, large after one month as Cohen's d value is more than 0.8, and large after three months as Cohen's d value of is above 0.8as shown in **Table 5.**

Follow up time	Immediately after	1 week after	1 month after	3 months after
Cohen's d standard at JUH	-0.425037954	-0.715859691	-0.81944064	-0.926997666
Cohen's d standard at HSK	-0.711169157	-0.934689394	-1.436548843	-1.24704665

Table 5: Cohen's standard at JUH and HSK at multiple time intervals after the injection.

The statistical significance in favor of peri-articular injections was calculated for each follow-up, and the results at JUH and HSK are shown in **Table 6**. Based on the results at JUH, there was no significance in the "immediately after" period ($p>0.05$). Consecutive follow-ups showed significant improvement ($p<0.05$). Based on the results at HSK, significance in favor of periarticular injections was seen early on in the "immediately after" ($p<0.05$). In a double-blind, controlled study that studied the efficacy of periarticular corticosteroid treatment of SIJ in non-spondyloarthropathy patients with chronic low back pain in the SIJ region, both the VAS and the NRS-11 had improved significantly in patients treated with a periarticular injection of methylprednisolone acetate and lidocaine at the one month's follow-up examination [27].

Follow up	Before	Immediately after	1 week after	1 month after	3 months after
Sig(2-tailed) at JUH	0.626	0.161	0.021	0.009	0.004
Sig(2-tailed) at HSK	0.007	0.015	0.002	0.000	0.000

Table 6: The statistical significance in favor of peri-articular injections at JUH and HSK at multiple time intervals.

Limitations

During our study, we encountered several limitations, in which the sample size was the most important. This limitation can be overcome by integrating our study into a larger scale study, including multiple centres. With a larger sample size, other variables can be assessed, such as BMI, occupation, and lifestyle. Moreover, the female to male ratio was 5.647:1.0, compromising our ability to compare the response of the different procedures done between the two genders.

Conclusion

Intraarticular injection for Sacroiliac joint pain due to degenerative Sacroiliitis has different surgical approaches; our study found that periarticular injections were significantly superior to intra-articular injection.

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