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Comparative evaluation of ultrasound and fluoroscope guided intra-articular sacroiliac joint injection in patients with sacroiliac joint pain

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ABSTRACT

Background: Tissues which transmit pain in the lower back include disc, nerve root, dura, muscles, ligaments, facet joints, and sacroiliac joint (SIJ). The SIJ contributes around 13–30% in patients with chronic low back pain. The SIJ is difficult to enter with a needle because of its complex configuration. Ultrasound and fluoroscopy are the two tools which guide in performing SIJ injections. **Aims and Objectives:** The SIJ is susceptible to arthritis, trauma, and degeneration which lead to pain and dysfunction. Intra-articular SIJ injections (IASIJIs) have diagnostic and therapeutic value and have been administered for the treatment of SIJ pain. **Materials and Methods:** Sixty patients (aged 20–60 years) with pain patterns consistent with SIJ pain who did not respond to conservative treatment were included in the study. The patients were randomly divided into two groups of 30 each: Group U (n = 30): Ultrasound-guided IASIJI and Group F (n = 30): Fluoroscope-guided IASIJI. A total of 3 mL drug solution comprising 1 mL of 0.25% bupivacaine plus 2 mL of methylprednisolone (80 mg) was injected in both groups. **Results:** There was a statistically significant improvement in pain scores after IASIJI in both groups. The change in pain score was significantly more in Group F as compared to Group U at 3 and 6 months after IASIJI. Two weeks after IASIJI, the mean pain score in both groups remained < 2 at all time intervals throughout the study period. The variation in the Oswestry Disability Index (ODI) at different time intervals when compared to ODI before injection in both the groups was clinically and statistically significant ($P < 0.001$). The change in ODI was more in Group F as compared to Group U at all time intervals. Excellent patient satisfaction was reported by the majority of the patients at different time intervals in both groups. **Conclusion:** Both techniques were effective and provided good pain relief to the patients with SIJ pain. Fluoroscope-guided SIJ injection is better than ultrasound-guided SIJ injection in terms of improvement in pain score and functional disability.

Key words: Low back pain; Sacroiliac joint injection; Ultrasound

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INTRODUCTION

Tissues which transmit pain in the lower back include disc, nerve root, dura, muscles, ligaments, facet joints, and sacroiliac joint (SIJ). The SIJ contributes around 13–30% in patients with chronic low back pain.[1,2] Intra-articular SIJ injections (IASIJIs) are diagnostic and therapeutic for the treatment of SIJ pain. Intra-articular corticosteroid reduces joint inflammation and inhibits ectopic discharges from injured sensory nerves.[3,4] The SIJ is difficult to enter with a needle because of its complex configuration. Ultrasound and fluoroscopy are the two tools which guide in performing SIJ injections.[5]

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The advantage of ultrasound-guided IASIJI (UGIASIJI) is that sonography helps in the identification of anatomic characteristics, as the palpable landmarks can be different in different individuals. Ultrasound is radiation-free, easy to use and can provide real-time images in guiding the needle into the SIJ.[6-9]

Intra-articular SIJ corticosteroid injections must be performed ideally under fluoroscopic guidance, which is considered the gold standard for accurate drug placement. Fluoroscopic guidance and radiographic contrast administration confirm needle position and spread of the drug in the joint while avoiding periarticular or intramuscular placement.

Aims and objectives

We conducted this prospective randomized study to compare the ultrasound and fluoroscope-guided IASIJI (FGIASIJI) in patients with SIJ pain with the primary objective of improvement in pain and disability. The secondary objectives of the study were the requirement for repeat injections, ease of administering the injection and related side effects.

MATERIALS AND METHODS

After getting approval from the institutional ethical committee (No. Surg/Dean/2864), this prospective, randomized study was conducted at the pain management center of a postgraduate institute. Sixty patients of either sex and age more than 20 years attending pain management center fulfilling following criteria were included in the study: (i) history, physical examination, and pain pattern consistent with SIJ pain; (ii) magnetic resonance imaging (MRI) showing SIJ findings corresponding with the patient's clinical symptoms; (iii) oral analgesics of various categories such as non-steroidal anti-inflammatory drugs, oral opioids, centrally acting muscle relaxants, and physiotherapy not able to produce adequate effect after 6 weeks of treatment. Patients with known contraindications for SIJ injection, a history of adverse reactions to local anesthetics or steroids, a previous history of SIJ injection, and uncontrolled diabetes mellitus were excluded from the study.

After eliciting a clinical history, the patients were examined, and imaging studies such as MRI were reviewed. The procedure was explained in detail to the patients and informed written consent was taken. A numeric rating scale (NRS) (0–10) was explained for the assessment of pain to all the patients. The patients were then randomly divided into two groups of 30 each by a computer-generated randomization number table. Group U (n=30): Patients were administered UGIASIJI and Group F (n=30): Patients were administered FGIASIJI.

Patients were placed in the prone position and the procedure was performed under strict aseptic precautions. Lignocaine (1%) was infiltrated subcutaneously. In Group U (Group I), a 23 G, 3½ inch spinal needle was advanced into the SIJ under ultrasound guidance. The needle was advanced in a medial to lateral direction (in-plane approach) until the needle was positioned in the SIJ, 3 mL drug solution comprising 1 mL of 0.25% bupivacaine plus 2 mL of methylprednisolone (80 mg) was then injected.

In Group F (Group II), a 23 G, 3½ inch spinal needle was advanced into the SIJ under fluoroscopic guidance, contrast (iohexol) 0.25–0.5 mL was injected to ensure intra-articular spread of injectate, then 3 mL drug solution comprising 1mL of 0.25% bupivacaine plus 2 mL of methylprednisolone (80 mg) was injected.

The sample size was calculated to achieve a power of 85% to show a difference of 20% change in NRS and Oswestry Disability Index (ODI) with a type I error rate of 5%. A change in ODI and NRS of 20% was found to be clinically relevant in previous studies and was used for sample size calculation in the present study.

The primary outcomes were patient satisfaction and improvement in pain and disability. The secondary outcomes were the requirement of repeat injection, its side effects, and complications. Before rating their pain, patients were asked to sit, stand, and walk. The pain was assessed using (NRS, 0–10) and was measured and recorded at the following time intervals: 1 h before the procedure, 1 h after the procedure, 2 weeks, 1 month, 2 months, 3 months, and 6 months after the injection.

Patient satisfaction was assessed after 2 weeks, 1 month, 2 months, 3 months, and 6 months of the injection on a 4-point scale; Excellent: When the pain decreased by 75% or more; Good: When the decrease in pain was by 50–74%; Fair: When decrease in pain was by 25–49%; Poor: When decrease in pain was <25%. The ODI was calculated at the following time intervals: 1 h before the injection; 2 weeks, 1 month, 2 months, 3 months, and 6 months after the injection.

The patients were followed for 6 months after the initial procedure to determine if further IASIJIs were required. Repeat IASIJIs were carried out using the same approach, if pain relief was not adequate (NRS>4). Side effects and complications during the injection, pain, and swelling at the injection site were recorded. Pain during the procedure was assessed on a 4-point scale: (1) No pain, (2) mild pain, (3) moderate pain, and (4) severe pain. At the end of the study period, all data were compiled and analyzed statistically.

The Statistical Package for the Social Sciences (SPSS) version 17.0 (IBM SPSS Statistics Inc. Chicago, Illinois, USA) was used for statistical analysis. To test the difference in age, weight, pain score, ODI score, and procedural time, an unpaired t-test was used. One-way analysis of variance (Friedman's) was used for comparison of pain score and ODI score at different time intervals within each group. Mann–Whitney U-test was used for the comparison of pain score and ODI score at different time intervals between the two groups. To compare patient satisfaction, sex distribution, number of SIJ injections and attempts to perform the procedure, complications, and pain while administering the injectate between the two groups, the Chi-square test was used. Results were taken as statistically significant if the $P \leq 0.05$.

RESULTS

The two groups were comparable regarding age, weight, and sex distribution (Table 1).

The variation in pain score in both the groups at different time intervals when compared to baseline was clinically and statistically significant ($P<0.001$). When pain scores were compared between the two groups, the pain score was clinically and statistically lower 1 h after IASIJI in Group U. The pain scores between the two groups were comparable at the rest of the time intervals of the study period. In Group U, the mean pain score (NRS score) before injection was 7.1±0.92 which decreased to 1.4±1.32 1 h after injection. The pain score was 1.56±0.89, 1.5±0.57, 1.23±0.62, 1.1±0.66, and 1.1±0.6 2 weeks, 1 month, 2 months, 3 months, and 6 months after injection, respectively. In Group F, the mean pain score (NRS score) before injection was 7.7±0.87 which decreased to 2.23±1.3 1 h after injection. The pain scores were 1.96±1.21, 1.70±1.23, 1.53±1.61, 1.06±0.94, and 0.93±0.78 2 weeks, 1 month, 2 months, 3 months, and 6 months after injection, respectively (Figure 1).

When patient satisfaction was compared between the two groups, it was clinically and statistically insignificant ($P=0.129$). The results show clinically and statistically comparable patient satisfaction between the two groups at all time intervals of the 6 month study period.

The variation in ODI score at different time intervals when compared to ODI score before injection in both the groups was clinically and statistically significant ($P<0.001$). In Group U, the mean ODI score before injection was 42.51±11.26 which decreased to 21.58±9.14 2 weeks after injection. The ODI score was 16.89±8.74, 11.75±8.41, 8.63±7.29, and 8.59±7.2 1 month, 2 months, 3 months, and 6 months after injection, respectively. In Group F mean ODI score before injection was 63.19±14.35 which decreased to 31.7±14.31 2 weeks after injection. ODI score was 24.09±12.56, 18.48±15.24, 10.88±9.18, and 8.90±9.04 1 month, 2 months, 3 months, and 6 months after injection, respectively. The change in ODI score was more in Group F as compared to Group U at all time intervals (Figure 2).

The number of patients requiring a second SIJ injection during the 6 months study period was 1 and 5 in Group F and U, respectively. It was statistically significant between the two groups ($P=0.01$). No patient required a third SIJ injection during the study period.

During IASIJI, the majority of the patients had mild pain on administration of the injectate (21 out of 31 in Group U and 24 out of 38 in Group F; $P>0.05$). However, all patients in Group U had some degree of pain on injection as compared to seven patients in Group F who had no pain on injection ($P=0.04$). Seven patients in Group U and three patients in Group F reported moderate pain on administration of the injectate. Three patients in Group U and four patients in Group F reported severe pain on administration of the injectate. The pain was temporary and was relieved within seconds of finishing the administration of the injectate.

DISCUSSION

In our study, both the groups were comparable regarding baseline patient profile. Eighty percent of the patients in our study were in the age group of 40–60 years and 65% of them were females. The females are regularly engaged in lifting heavy weights as a part of their daily routine; such as domestic work, agricultural work, and labor activities. The majority of the patients had degenerative disorder of SIJ which is more common in the elderly age group. Both the techniques of IASIJI, that is, UGIASIJI, Group U and

Table 1: Distribution of age, sex, and weight in the two groups

Parameter	Group U (UGIASIJI) n=30	Group F (FGIASIJI) n=30	P-value
Age (in years) mean±SD	45.50±13.27	46.90±11.46	0.664
Weight (in kg) mean±SD	55.83±9.41	60.03±10.89	0.115
Male to female ratio (%)	9:21 (30:70)	12:18 (40:60)	0.417

UGIASIJI: Ultrasound-guided intra-articular sacroiliac joint injection, FGIASIJI: Fluoroscope-guided intra-articular sacroiliac joint injection

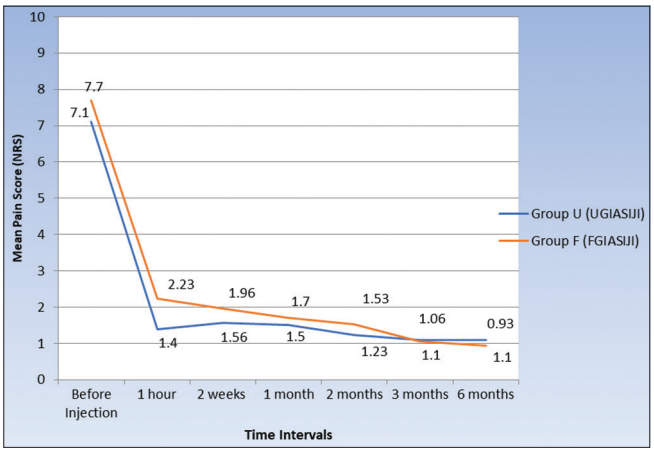

Figure 1: Pain score (numeric rating scale) at different time intervals in the two groups

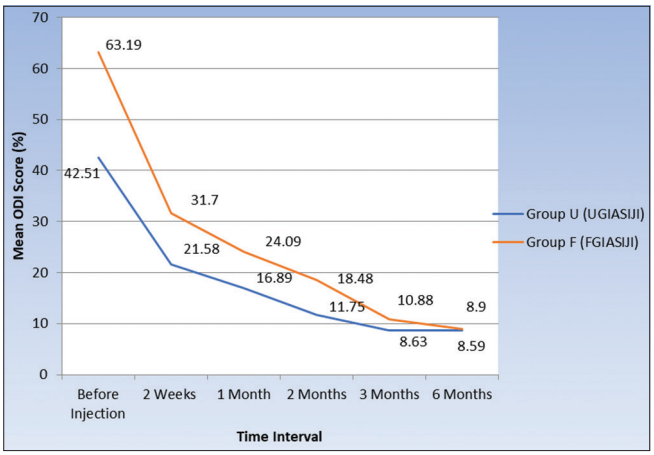

Figure 2: Oswestry Disability Index score at different time intervals in the two groups

FGIASIJI, Group F were effective and provided good pain relief to the patients with SIJ pain. However, the pain score was clinically and statistically lower 1 h after IASIJI in Group U (P=0.004). The pain scores between the two groups were comparable at the rest of the time intervals of the study period. Two weeks after IASIJI, the mean pain score in both groups remained < 2 at all time intervals throughout the study period. The change in pain score was significantly more in Group F as compared to Group U at 3 and 6 months after IASIJI (P<0.05). All patients in both groups had improvement in the NRS score of more than five points at all time intervals of the study period when compared to before injection NRS score. The mean ODI score was < 20% 2 months after the IASIJI and < 10% 6 months after IASIJI in both groups. With FGIASIJI, the change in the disability index was significantly better as compared to UGIASIJI at all time intervals (P<0.0001).

Patient satisfaction was comparable between the two groups at all time intervals of the 6-month study period. Excellent satisfaction was reported by the majority of the patients in both groups. Similar results have been observed in other studies.[9-12]

In the present study, we had planned to repeat the SIJ injection by the same technique, if pain relief was not adequate (NRS >4). Five patients in the UGIASIJI group and one patient in the FGIASIJI group required a second IASIJI. Although as per our study protocol, no more than three IASIJI were to be given during the 6 months study period.

It has long been accepted that intra-articular administration of corticosteroids decreases joint inflammation and inhibits ectopic discharges from injured sensory nerves. IASIJIs using corticosteroids such as triamcinolone, dexamethasone, betamethasone, and methylprednisolone have been used in different studies.[3,4,13,14] The SIJ is difficult to enter with a needle because of its complex configuration.

In this study, injections were performed in the first attempt in all patients. The mean time for UGIASIJI was significantly less than FGIASIJI possibly due to the handling of a bulky fluoroscope. FGIASIJI was done only after achieving adequate dye spread in the joint. The limitations of the use of UGIASIJI s are the risk of inadvertent intravascular injection, limitations with respect to injectate flow, and variable joint morphology.

Intra-articular SIJ corticosteroid injections have been advised to be performed ideally under fluoroscopic guidance, which is considered the gold standard for accurate drug placement.[14] The use of fluoroscopy involves exposure to radiation and administration of a contrast medium. However, exposure to radiation can be minimized by following standard operational principles.

In our study, we did not observe any serious side effects related to the technique or the injectate. Five patients each in the two groups reported soreness at the injection site after SIJ injection. The soreness was mild and resolved within 2 days with the use of cold fomentation and concurrent medications for SIJ pain.

Limitations of the study

There are a few limitations in this study. First, a single senior pain practitioner performed all the injections hence the study findings reflect the expertise of a single performer only. This fact can limit the generalizability of our study results. Second, as we have followed the patients only for 6 months to study the short-term effects, longer follow-ups are ideally desired, up to 1-year duration, to find out the long-term effects of such studies. Finally, because of the use of fluoroscopy, it was difficult to conduct a double-blinded and controlled study.

CONCLUSION

Both ultrasound and fluoroscope guided SIJ injections are safe and effective techniques for the management of SIJ pain. Both techniques provide good pain relief and improvement in disability of the patients. The time required to administer ultrasound-guided SIJ injection is less than fluoroscope-guided SIJ injection. The use of ultrasound to perform SIJ injection aids in the identification of anatomic characteristics and can guide the placement of a needle into the SIJ but it offers no major advantage over fluoroscope-guided SIJ injection. Fluoroscope-guided SIJ injection is better than ultrasound-guided SIJ injection in terms of improvement in pain score and functional disability.

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Authors Contribution:
K- Conception, design, material data collection, statistical analysis, manuscript preparation and submission of article, writing, and critical review;
AK- Conception, supervision, material data collection, manuscript editing, and revision; **NM**- Conception, supervision, material data collection, manuscript preparation, and submission of article; **A**- Design, statistical analysis, and manuscript revision; **J-** Design, writing, and literature review; **NyM**- Collection of data, analysis, and preparation of figures and tables.

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