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Original Research Article

Assessing Pain and Functional Improvement Six Months after Sacroiliac Joint Injection: an Analysis Based on Anaesthetic Response and Physical Exam Manoeuvres

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Conflict of interest: Nil

Abstract:

Objectives: To evaluate sacroiliac joint (SIJ) injection outcomes with local anesthetic and corticosteroid in sacroiliitis.

Methods: Thirty-four patients, diagnosed with SIJ pain, were given SIJ injections containing a combination of 2% lidocaine and triamcinolone 40 mg/ml. Before and after the injection, pain provocation tests were conducted and recorded. Follow-up assessments at two to four weeks and six months included pain levels measured on a numeric rating scale (NRS) and the Oswestry Disability Index (ODI).

Results: In the analysis of overall group outcomes (without considering specific PE manoeuvres or anaesthetic blocks), improvements were noted in a 58.8% (95% confidence interval [CI] = +/-16.5%) reduction of ≥2 points on the NRS, a 32.4% (95% CI = +/-15.7%) reduction of ≥50% on the NRS, and a 38.2% (95% CI = +/-16.3%) reduction of ≥30% on the ODI within two to four weeks. Similar enhancements were observed six months post-injection. Stratifying outcomes based on pre-injection PE did not show significant differences at either time point. However, when stratified according to the presence of a 100% post-injection anaesthetic response, a significant difference was found in ≥50% NRS improvement within two to four weeks. Stratification into true positive/true negative groups (TP/TN) revealed significant differences in ≥50% NRS improvement at two to four weeks, and in both ≥50% NRS and ≥30% ODI improvement at six months. Patients more likely to have true SIJ pain (i.e., TP) displayed increased injection response, with a 75% (95% CI = +/-30.0%) improvement of ≥2 points on the NRS and a 62.5% (95% CI = +/-33.5%) improvement of ≥50% on the NRS and ≥30% on the ODI within two to four weeks, with similar results at six months.

Conclusion: The effectiveness of SIJ steroid injections solely based on clinical referral diagnosis is doubtful, indicating the need for more precise selection criteria to assess true efficacy.

Keywords: Sacroiliac Joint, Low Back Pain, Corticosteroid Injection, Physical Exam, Anesthetic Response.

Introduction

The sacroiliac joint (SIJ) is a common source of lower back and buttock pain. In the United States, corticosteroid injections for SIJ pain are frequently administered. A systematic review in 2015 suggested moderate evidence supporting the efficacy of therapeutic SIJ corticosteroid injections. However, it remained uncertain whether the response to image-guided intra-articular anaesthetic injection in the SIJ could predict the response to therapeutic treatment. A recent study found that complete pain relief immediately after a corticosteroid and anaesthetic intra-articular SIJ injection had a positive likelihood ratio of 2.6 (95% confidence interval [CI] = 1.1–5.9) for predicting 50% pain relief at two to four weeks post-injection. Conversely, the absence of such a response had a negative likelihood ratio of 0.0 (95% CI = 0.0–2.1) for at least 50% pain relief at two to four weeks. Roughly 20% to 30% of patients suspected to have SIJ pain based on clinical exams are likely affected. Although some studies propose that a combination of three positive physical exam manoeuvres can aid in diagnosing SIJ pain, this finding has not been consistently replicated. These inconsistencies might explain why studies focusing on patients selected through history and exam criteria report success rates as low as 6–23% for sacroiliac joint corticosteroid injections. This study presents outcomes at two to four weeks and six months, measured using the numeric rating scale (NRS) and Oswestry Disability Index (ODI), for patients undergoing SIJ corticosteroid injections. Referrals for these injections were based on clinical assessments, and data were collected to document pre- and post-injection physical exam results as well as post-injection anaesthetic responses. Our

findings reveal an enhanced response to injections in patients more likely to have genuine SIJ pain, as determined by specific stratification methods.

Methods

This research builds upon a previously documented patient group. Approval for this prospective study (PROTOCOL #31227) was granted by the Institutional Review Board at Stanford University, and participants were recruited from this academic medical centre. Detailed enrolment criteria and study design have been previously published.

Patients were referred for SIJ steroid injections by certified physicians in Physical Medicine and Rehabilitation or Orthopaedic Surgery based on clinical assessments. All individuals had already attempted conservative treatments and experienced pain rated ≥4/10 on the 0–10 numeric rating scale (NRS) that significantly limited their functionality. All patients referred to the group were given the opportunity to join the study on the day of their scheduled SIJ injection. Moreover, all eligible patients were offered the SIJ injection regardless of their decision to participate in the study.

Pre-Injection: Patients were assessed and examined in the preoperative area before receiving the injection. A Medical Doctor conducted a standard examination, which involved various maneuvers including flexion abduction external rotation (FABER), thigh thrust, Gaenslen's test, sacral distraction, lateral compression, and sacral thrust. The pain score on the 0–10 NRS was recorded either during or immediately after these manoeuvres; however, the question regarding pain score was not asked before the manoeuvres were performed. It's important to note that SIJ injection was offered to patients regardless of the findings from the physical examination.

Injection: All SIJ injections took place at an outpatient surgical centre and were administered by one of four physiatrists who had completed specialized training, either with or without the involvement of trainees.

The injections adhered to the current guidelines outlined by the Spine Intervention Society. This protocol included the use of multiple fluoroscopic views to confirm the accurate placement of the needle and real-time fluoroscopy with contrast to ensure the presence of an arthrogram, as depicted in Figure 1. Each injection consisted of a 2-cc mixture, comprising 1 cc of 2% lidocaine and 1 cc of triamcinolone 40 mg/mL. Notably, no patients were given intravenous sedation or oral anxiolytics during the periprocedure period.

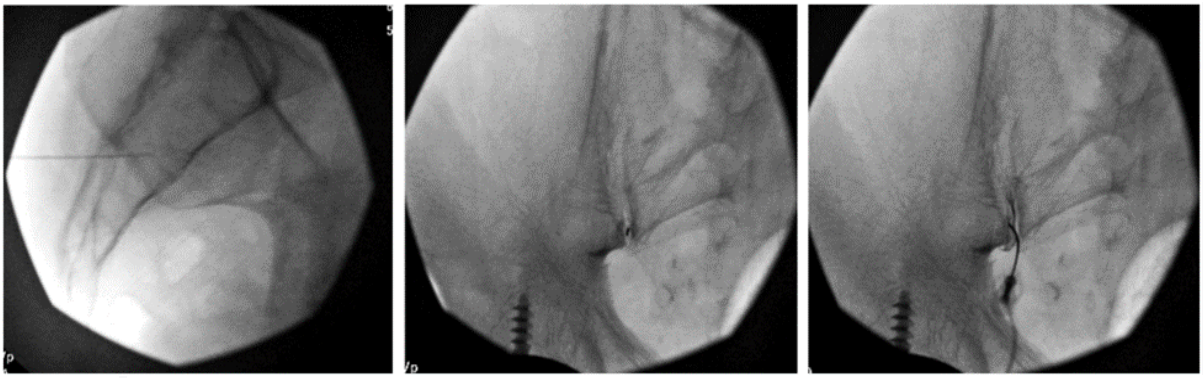

Figure 1: Representative fluoroscopy-guided diagnostic sacroiliac joint injection. A) Precontrast lateral view of the sacroiliac joint confirming needle tip position. B) Precontrast anterior-posterior view of the sacroiliac joint confirming needle tip position. C) Intra-articular injection of sacroiliac joint with contrast in anterior-posterior view.

Post injection: Between ten to fifteen minutes after the injection, patients were asked to assess the percentage of pain relief. Following this, the same physician who conducted the pre-injection examination repeated the six physical exam manoeuvres and recorded a post injection NRS pain score to evaluate the response to the intra-articular anaesthetic. Patients who reported 100% pain relief after the injection and were found to be pain-free during the post injection physical exam were categorized in the true positive group. Independent research coordinators, not involved in the injection or clinical care, collected patient NRS and ODI outcomes at two to four weeks and six months post injection. The two- to four-week follow-up occurred during a routine clinic visit, while the six-month follow-up was conducted through telephone interviews. There were no alterations in patient care between the injection and the in-person follow-up at two to four weeks. Patients were provided with standard of care between the two- to four-week and six-month follow-up periods.

Statistics: The data analysis involved categorizing outcomes based on the percentage of pain relief achieved, with associated 95% confidence intervals reported. Categorical data were assessed using Chi-

square tests without Yates' correction, along with two-tailed P values. Success at two to four weeks and six months was defined as meeting the minimal clinically important change (MCIC) criteria: a two-or-more-point improvement on the NRS, ≥50% improvement in NRS, and ≥30% improvement in ODI (Figures 2–5). The analysis took into account the presence or absence of at least three positive physical exam manoeuvres before injection (Figure 3). Additionally, the study analysed outcomes based on the immediate response to the anaesthetic, considering previously established likelihood ratios indicating that 100% relief or lack thereof during the immediate post injection anaesthetic phase had the best positive and negative likelihood ratios, respectively (Figure 4). Finally, responses in patients believed to have the highest likelihood of SIJ pain (termed true positive, involving three or more positive pre-injection physical exam manoeuvres, 100% anaesthetic block, and fewer than three post-injection manoeuvres) were compared with those believed to have the lowest likelihood of SIJ pain (termed true negative, involving fewer than three pre-injection physical exam manoeuvres and <100% anaesthetic response) (Figure 5).

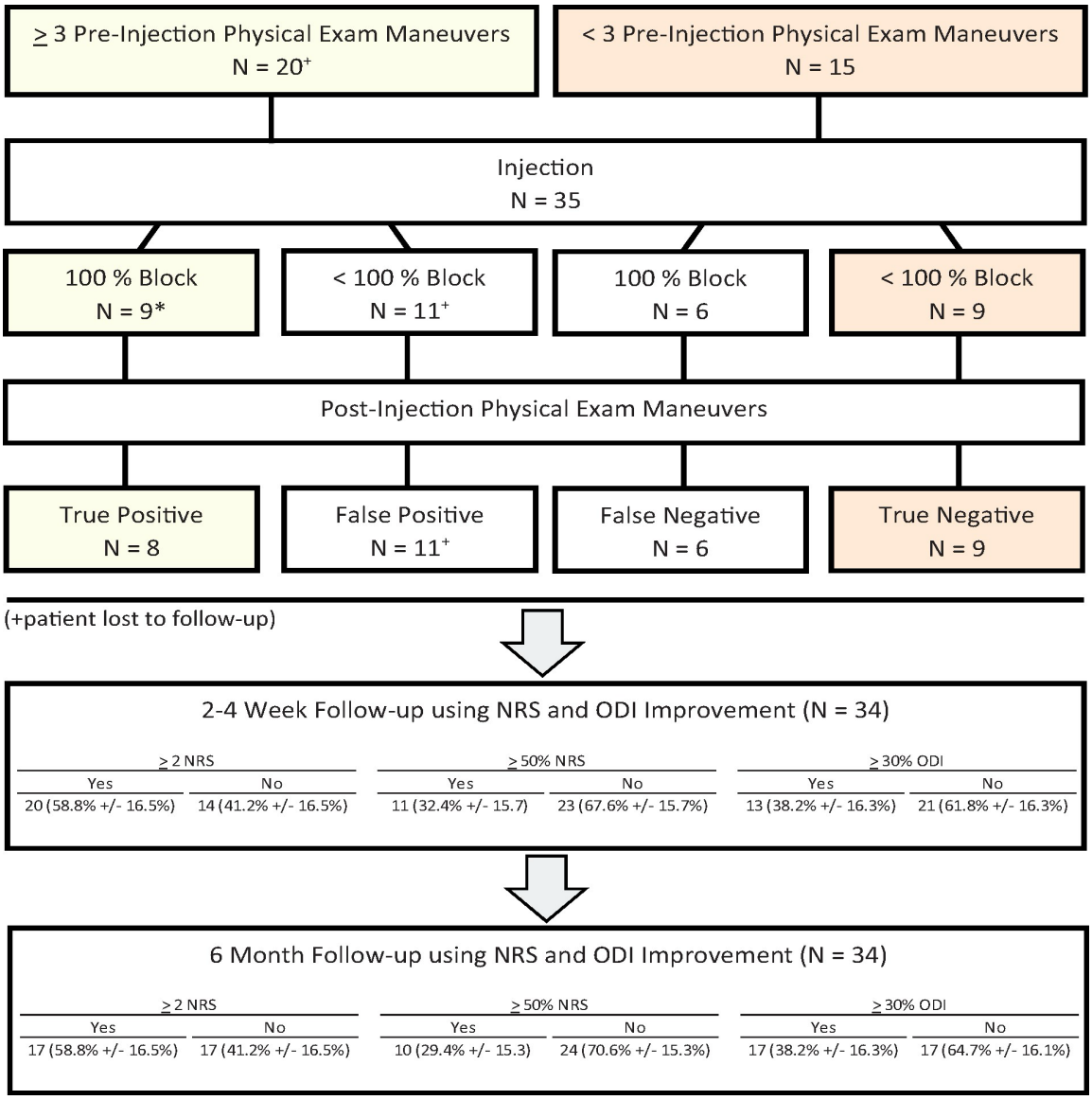

Figure 2: Experimental flow and patient groups. *One patient reported 100% relief after block but had positive physical exam findings and was therefore excluded from the true positive group. +One patient was lost to follow--up in the false positive group (more than three physical exam maneuvers pre--injection and negative block); this patient was excluded in the follow--up analysis at 2-4 weeks and six months. NRS = numeric rating scale for pain; ODI = Oswestry Disability Index.

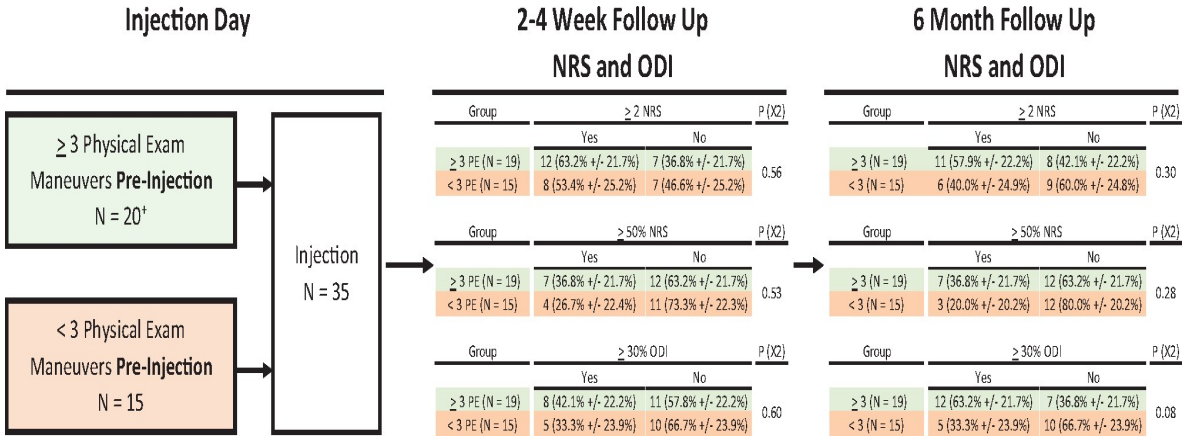

Figure 3: Outcomes stratified by more than three positive physical exam (PE) maneuvers vs fewer than three positive PE maneuvers. Chi-square without Yates' correction; two-tailed P value. +One patient in the more than three physical exam maneuvers pre-injection group was lost to two- to four-week and six-month follow-up and therefore could not be included in the analysis of NRS and ODI for the two- to four-week and six-month follow-up. NRS = numeric rating scale for pain; ODI = Oswestry Disability Index.

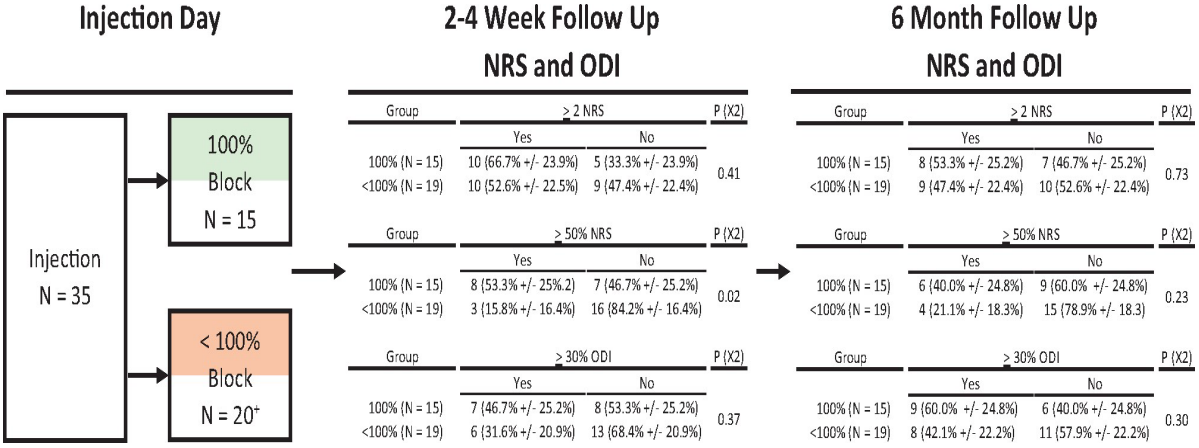

Figure 4: Outcomes stratified by 100% responder's vs <100% responders (per patient report). Chi-square without Yates' correction; two-tailed P value reported. +One patient in the <100% block per patient report was lost to two- to four-week and six-month follow-up and therefore could not be included in the analysis of NRS and ODI for the two- to four-week and six-month follow-up. NRS = numeric rating scale for pain; ODI = Oswestry Disability Index.

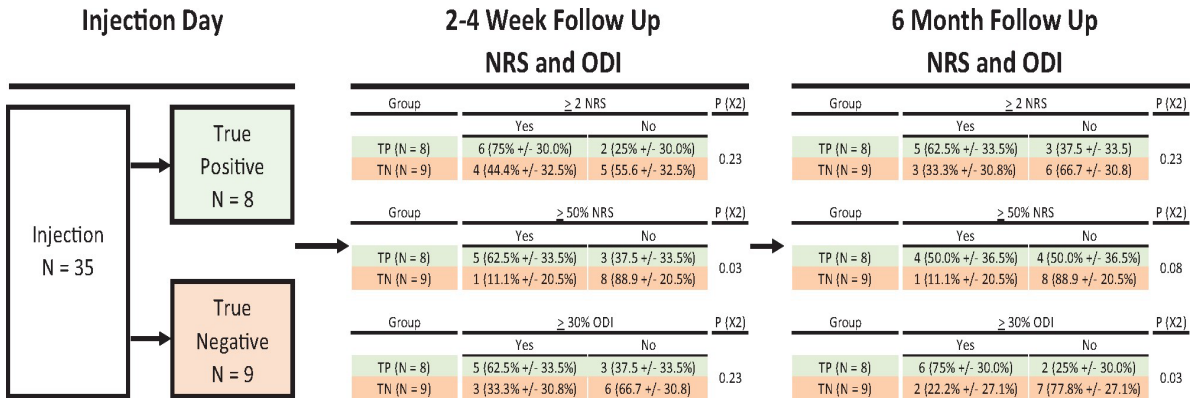

Figure 5: Outcomes stratified by true positive vs true negative group. Note that one patient reported 100% relief after block but had positive physical exam findings postinjection and was therefore excluded from the true positive group. Chi-square without Yates' correction; two-tailed P value reported. NRS = numeric rating scale for pain; ODI = Oswestry Disability Index; TP = true positive (three or more positive physical exam findings pre-injection, positive anesthetic block, and positive postinjection for three or more physical exam findings); TN = true negative (three or more negative physical exam findings pre-injection, negative anesthetic block).

Results

Out of a total of 39 consecutive subjects approached for the study, three declined participation, leaving 36 who provided consent and were enrolled. One subject was immediately withdrawn due to difficulty accessing the SIJ using live fluoroscopy. The remaining 35 subjects underwent fluoroscopically confirmed injections of both anesthetic and corticosteroid into the SIJ joint. Among these, 28 patients (80%) were female, and seven (20%) were male. The average age was 58.3 years. Before the injection, the mean pain rating was 6.09, with a standard deviation of 2.17. A significant portion, 30 out of 35 patients (86%), had been experiencing pain for over a year. Unilateral injections were administered to 26 patients (74%), while nine (26%) received bilateral injections. Almost all enrolled patients, 34 out of 35 (97%), completed follow-up assessments at both two to four weeks and six months. The single patient lost to follow-up had experienced a 70% improvement in pain immediately post-injection and displayed three positive physical exam maneuvers before the injection; as a result, this patient could not be categorized into the true positive or true negative group.

Outcomes at Two to Four Weeks and Six Months

In the overall analysis of outcomes, not categorized by physical exam or anesthetic block, results at two to four weeks showed that 20 out of 34 patients (58.8%, 95% CI = +/-16.5%) experienced a reduction of at least two points on the NRS, 11 out of 34 (32.4%, 95% CI = +/-15.7%) had a >50% decrease in NRS, and 13 out of 34 (38.2%, 95% CI = +/-16.3%) achieved a >30% reduction in ODI (refer to Figure 2). At the six-month mark, 17 out of 34 patients (50.0%, 95% CI = +/-16.8%) had at least a two-point reduction in NRS, 10 out of 34 (29.4%, 95% CI = +/-15.3%) experienced a 50% reduction in NRS, and 17 out of 34 (50.0%, 95% CI = +/-16.8%) saw a 30% reduction in ODI (refer to Figure 2).

Outcomes at Two to Four Weeks and Six Months Stratified by Three or More Positive Physical Exam Maneuvers

Outcomes were further analyzed based on pre-injection physical exam results. Among the 35 patients, 20 (57.1%, 95% CI = +/-16.4%) displayed at least three positive physical exam maneuvers just before the injection (as depicted in Figure 2 under "at least three pre-injection physical exam maneuvers" and Figure 3). One patient with positive physical exam findings was lost to follow-up; this individual was categorized as false positive because their pre-injection physical exam results did not align with the anesthetic block, as reported by the patient and observed during the post-injection physical exam (Figure 2, + superscript). Consequently, 19 patients were included in the follow-up analysis at both two to four weeks and six months for pre-injection positive physical exam results (Figure 3).

At the six-month mark, among those with at least three positive physical exam maneuvers, 11 out of 19 (57.9%, 95% CI = +/-22.2%) experienced a reduction of at least two points on the NRS, seven out of 19 (36.8%, 95% CI = +/-21.7%) achieved a >50% decrease in NRS, and 12 out of 19 (63.2%, 95% CI = +/-21.7%) had a >30% improvement in ODI (Figure 3). Similar trends were observed at two to four weeks, with seven out of 19 (36.8%, 95% CI = +/-21.7%) achieving a 50% reduction in NRS, 12 out of 19 (63.2%, 95% CI = +/-21.7%) having at least a two-point improvement on NRS, and eight out of 19 (42.1%, 95% CI = +/-22.2%) experiencing a >30% improvement in ODI (Figure 3). Notably, chi-square analysis did not uncover any significant differences in outcomes between the groups with three or more positive physical exam findings and those with fewer than three positive physical exam findings at both two to four weeks and six months (Figure 3).

Outcomes at Two to Four Weeks and Six Months, Stratified by 100% Post injection Anesthetic Response per Patient Report

Among the 35 patients, 15 (42.8%, 95% CI = +/-16.4%) experienced immediate 100% relief after the injection (as shown in Figure 4). Among those with three positive physical exam maneuvers, nine out of 20 (45.0%, 95% CI = +/-21.8%) reported a 100% response to the anesthetic post-injection, as indicated by the green box in the third row of Figure 2 (labeled "100% block"). Notably, six patients with fewer than three positive physical exam findings also reported 100% relief after the injection, as represented in the white box in the third row of Figure 2 (labeled "100% block").

Upon stratifying based on the response to the initial anesthetic block, specifically evaluating the immediate 100% responders, 10 out of 15 (66.6%, 95% CI = +/-23.9%) had at least a two-point improvement in NRS, eight out of 15 (53.3%, 95% CI = +/-25.2%) achieved a >50% reduction in NRS, and seven out of 15 (46.7%, 95% CI = +/-25.2%) experienced a >30% improvement in ODI at two to four weeks post-injection (Figure 4). At six months, eight out of 15 (53.3%, 95% CI = +/-25.2%) had at least a two-point improvement in NRS, six out of 15 (40.0%, 95% CI = +/-25.8%) had at least a 50% reduction in NRS, and nine out of 15 (60.0%, 95% CI = +/-24.8%) achieved at least a 30% improvement in ODI (Figure 4).

Among those with a >50% NRS reduction at two to four weeks, five maintained this improvement at six months. Three patients experienced a slight

reduction in their improvement, while an additional patient, initially 37.5% improved at four weeks, achieved a 50% improvement at six months. Except for the >50% NRS stratification at two to four weeks, chi-square analysis did not identify any significant differences in outcomes between the groups with 100% and <100% anesthetic response at both two to four weeks and six months (Figure 4)

Outcomes at Two to Four Weeks and Six Months Stratified by True Positive and True Negative

Following the analysis of physical exams and anesthetic responses, the outcomes at two to four weeks and six months were stratified into true positive and true negative groups (as illustrated in Figure 2, denoted as Figure 5). Among the nine patients reporting a 100% block, eight (88.9%, 95% CI = +/-20.5%) also experienced no pain during post-procedure physical exam maneuvers. Therefore, eight out of 35 patients (22.9%, 95% CI = +/-13.9%) displaying three positive exam maneuvers before injection, 100% relief after injection, and fewer than three positive exam maneuvers afterward (indicating a positive block as per post-injection physical exam) were considered most likely to have true SIJ pain (Figure 2, labeled as true positive). At two to four weeks, six out of the eight (75%, 95% CI = +/-30.0%) and at six months, five out of the eight (62.5%, 95% CI = +/-33.5%) showed at least a two-point improvement in NRS (Figure 5). Additionally, five out of the eight (62.5%, 95% CI = +/-33.5%) and six out of the eight (75%, 95% CI = +/-30.0%) achieved at least a 30% improvement in ODI at two to four weeks and six months, respectively (Figure 4).

For the nine patients out of 35 (25.7%, 95% CI = +/-14.5%) who did not display three positive exam maneuvers before injection and experienced <100% relief afterward, categorizing them as least likely to have SIJ pain and termed true negative (Figure 2, true negative), the outcomes were assessed (Figure 5). At two to four weeks, four out of the nine (44.4%, 95% CI = +/-32.5%) showed at least a two-point improvement in NRS, and one out of the nine (11.1%, 95% CI = +/-20.5%) achieved a 50% improvement in NRS. At six months, three out of the nine (33.3%, 95% CI = +/-30.8%) experienced at least a two-point improvement in NRS, and two out of the nine (22.2%, 95% CI = +/-27.1%) achieved a 30% improvement in ODI (Figure 5). Chi-square analysis demonstrated a significant difference between the true positive and true negative groups for at least a 50% improvement at the two- to four-week follow-up and at least a 30% improvement in ODI at the six-month follow-up (Figure 5).

Conclusion

This study highlights that among patients referred with a clinical diagnosis of sacroiliac joint pain and treated with corticosteroid and anesthetic injections, there is only a moderate success rate in achieving clinically significant improvements in pain and function. The observed trend, indicating enhanced efficacy of injections in patients with genuine intra-articular SIJ pain (true positives), emphasizes the necessity for further research to pinpoint factors predicting positive outcomes from these injections.

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