Pain Physician 2025; 28:261-286 • ISSN 1533-3159

Systematic Review

A Systematic Review And Meta-Analysis Of Randomized Trials Of Therapeutic Intraarticular Facet Joint Injections In Chronic Axial Spinal Pain

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Disclaimer: There was no external funding in the preparation of this article.

Conflict of interest: Dr. Hirsch receives grants or contracts from Neiman Health Policy Institute, is a consultant for Medtronic, Relievant, and Sanofi, and is the Chair CSMB of neurovascular studies for Balt: Rapid Medical. All other authors certify that he or she, or a member of his or her immediate family, has no commercial association (i.e., consultancies, stock ownership, equity interest, patent/licensing arrangements, etc.) that might pose a conflict of interest in connection with the submitted article.

Article received: 02-21-2025
Accepted for publication: 04-02-2025

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Background: Chronic axial spinal pain remains a leading cause of disability. Therapeutic interventional modalities for managing axial spinal pain of facet joint origin include intraarticular injections, facet joint nerve blocks, and radiofrequency neurotomy.

Based on multiple randomized controlled trials (RCTs), systematic reviews, and clinical guidelines, the evidence supporting intraarticular facet joint injections is rated as Level III, with a weak to moderate recommendation for managing spinal facet joint pain.

Objective: To evaluate intraarticular facet joint injections as a therapeutic option for managing chronic axial spinal pain of facet joint origin.

Study Design: A systematic review and meta-analysis of RCTs involving intraarticular facet joint injections, conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist.

Methods: A comprehensive literature search was conducted across multiple databases from 1966 through February 2025, including manual searches of bibliographies from known review articles. The methodological quality and risk of bias for the included studies were assessed.

Evidence was graded using the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) criteria. The level of evidence was classified using a modified best evidence synthesis, ranging from Level I to Level V.

Outcome Measures: The primary outcome measure was the proportion of patients achieving significant pain relief and functional improvement of more than 50% for a minimum of 3 months. Duration of relief was categorized as short-term (< 6 months) and long-term (> 6 months).

Results: This analysis identified 12 high-quality and 2 moderate-quality RCTs based on Cochrane review criteria, and 11 high-quality and 3 moderate-quality RCTs based on Interventional Pain Management Techniques – Quality Appraisal of Reliability and Risk of Bias Assessment (IPM-QRB) criteria. Based on grade assessment, there were no high quality trials.

Evidence synthesis using both qualitative and quantitative analyses, along with GRADE assessment, indicated Level IV (limited evidence), with low certainty and a low level of recommendation.

Limitations: The primary limitation is the continued paucity of high-quality literature.

Conclusion: Based on qualitative analysis and GRADE assessment, intraarticular facet joint injections are supported by Level IV evidence, with limited quality, low certainty, and a low strength of recommendation.

Key words: Facet joint pain, facet joint intraarticular injections, facet joint nerve blocks, spinal pain, low back pain, neck pain, randomized controlled trials, systematic review, meta-analysis

Pain Physician 2025: 28:261-286

Chronic spinal pain, whether associated with extremity pain, chest wall pain, or headaches, remains one of the leading causes of disability and healthcare expenditures in the United States and worldwide (1-12). Numerous studies on U.S. health and disability trends (13), as well as cost analyses related to low back and neck pain and other musculoskeletal disorders (13,14), underscore the growing burden of disability and escalating healthcare costs. These conditions consistently rank among the most expensive in disease category spending.

A 2024 report by the National Center for Health Statistics (NCHS) (15) on chronic and high-impact chronic pain in U.S. adults during 2023 found that these conditions were the primary reasons adults sought medical care. Chronic pain is associated with reduced quality of life, opioid misuse, increased anxiety and depression, and unmet mental health needs. According to the report, 24.3% of adults experienced chronic pain, while 8.5% reported high-impact chronic pain during the past 3 months in 2023—an increase from 2019 figures of 20.4% and 7.4%, respectively (15).

Additional contributing factors include rising obesity rates (16,17) and the adverse effects of nicotine use (18). Notably, chronic pain remains one of the most prevalent health problems linked to nicotine use. The prevalence of combustible nicotine product use among individuals with chronic pain is more than double that observed in the general population (28% to 68%). Among those receiving treatment for chronic pain, dual users of cigarettes and e-cigarettes demonstrated significantly higher levels of anxiety, depression, pain-related disability, and opioid medication use (18).

Pain prevalence differs by spinal region, with the lumbar spine being most commonly affected (43%), followed by the cervical (32%) and thoracic spine (13%) (19). One-year prevalence of low back and neck pain ranges from 22% to 65%, while lifetime prevalence reaches 84% for low back pain and 67% for neck pain. Chronic spinal pain can persist for over a year in up to 60% of patients, even following conservative treatment or surgery (3).

In a 2024 study, Williamson et al (20) investigated persistent back pain in community-dwelling older adults and found that 77% continued to report back pain after 2 years; 25% reported leg pain, and 14% experienced severe back pain that interfered with daily activities. These findings align with the 2023 NCHS survey data (15). Furthermore, 41.2% of participants reported no change in symptoms over 2 years, and 17.1% reported worsening symptoms. Five key factors were associated with severe pain limitations at follow-up, including pain characteristics, confidence in walking, and attitudes toward activity in later life.

Individuals with chronic low back or neck pain are approximately three times more likely to have comorbid conditions than the general population (21). These spinal conditions are closely linked to physical functional decline and increased mental health issues, including depression, generalized anxiety disorder, and somatization (3,20,22). Chronic spinal pain has also been associated with a higher likelihood of similar pain syndromes in the offspring of affected individuals as they enter adulthood (23).

Williamson et al (20) also observed that back pain accompanied by leg pain significantly worsened outcomes in older adults, increasing the risk of poor long-term outcomes by approximately 70%. A diagnosis of spinal stenosis in patients with both back and leg pain was similarly associated with adverse outcomes. These findings highlight the importance of identifying multisite pain and symptom presentation in evaluating risk for long-term disability in older adults.

Based on current literature, controlled diagnostic blocks have identified the intervertebral discs, facet joints, nerve root dura, and sacroiliac joints as potential sources of spinal and extremity pain (3). Among interventional options for managing axial spinal pain originating from facet joints, three primary modalities are frequently utilized: radiofrequency neurotomy, intraarticular injections, and therapeutic facet joint nerve blocks (3). Of these, facet joint intraarticular injections are typically employed for therapeutic purposes, whereas facet joint nerve blocks serve primarily for diagnostic evaluation using controlled diagnostic blocks (3).

Despite advancements in diagnostic understanding, the use of interventional techniques for diagnosing and treating facet joint pain remains subject to ongoing debate. Several publications have documented a deceleration in procedural growth patterns across the United States (1-8,12,24-28). Multiple studies have examined diagnostic accuracy, clinical effectiveness (3,12,25,29-34), and cost utility, with many reporting favorable outcomes (31-34).

One comprehensive guideline (3) systematically evaluated the evidence for all interventional strategies in the management of facet joint pain, including intraarticular injections. For therapeutic facet joint interventions, the level of evidence ranged from Level

II (moderate strength of recommendation) to Level V (weak strength of recommendation) for long-term improvement:

- Cervical facet joint intraarticular injections: Level V evidence with weak recommendation,
- Lumbar intraarticular injections: Level IV evidence with weak recommendation,
- Thoracic intraarticular injections: Level III evidence with weak to moderate recommendation.

Although this guideline (3) was based on systematic review without meta-analysis, it demonstrated that evidence supporting facet joint blocks was comparable to that for radiofrequency neurotomy in the cervical and lumbar regions. In contrast, for the thoracic spine, facet joint nerve blocks had Level II support, compared to Level III for thoracic radiofrequency ablation. Overall, both lumbar and cervical spine interventions showed Level II evidence with moderate strength of recommendation. However, other systematic reviews of varying quality have reported inconsistent findings (35-46).

This systematic review and meta-analysis of randomized controlled trials (RCTs) was conducted to evaluate the clinical effectiveness of facet joint intraarticular injections in managing chronic axial spinal pain of facet joint origin, including the cervical, thoracic, and lumbar spine.

Methods

A systematic review and meta-analysis were conducted in accordance with the methodological and reporting standards outlined by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (47). Additional methodological approaches from previous reviews were also incorporated (1,2,9-11,29,30,48-54).

Objective

The objective of this systematic review and meta-analysis of randomized controlled trials (RCTs) was to evaluate the efficacy and effectiveness of facet joint intraarticular injections in the management of chronic axial spinal pain of facet joint origin, including the cervical, thoracic, and lumbar spine regions.

Eligibility Criteria

All RCTs evaluating therapeutic facet joint intraarticular injections with a minimum follow-up period of 3 months were included. Studies were required to utilize either diagnostic blocks or clinical criteria to establish the diagnosis of facet joint pain.

Exclusion criteria encompassed studies involving atlantooccipital or atlantoaxial joint injections, as well as sacroiliac joint injections.

Information Sources

A comprehensive literature search was performed to identify relevant RCTs conducted in all countries and published in any language. The search was executed across multiple databases without language restrictions.

1. PubMed from 1966 https://pubmed.ncbi.nlm.nih.gov/
2. Cochrane Library https://www.cochranelibrary.com/
3. Google Scholar https://scholar.google.com/
4. US National Guideline Clearinghouse (NGC) https://www.ahrq.gov/gam/index.html
5. Clinical Trials https://www.clinicaltrials.gov/
6. Previous systematic reviews and cross-references
7. All other sources including non-indexed journals and abstracts

The search period was from 1966 through February 2025.

Search Strategy

The search strategy included chronic axial spinal pain treated with facet joint intraarticular injections. The search terms included: ((((((spinal pain, chronic low back, neck, mid back, and upper back pain) OR chronic neck pain OR chronic low back pain OR chronic thoracic pain) OR facet joint pain) OR post lumbar surgery syndrome, post cervical surgery syndrome, post thoracic surgery syndrome) OR zygapophysial)) AND ((((facet joint) OR zygapophyseal) OR zygapophysial) OR facet joint nerve block OR intraarticular injection OR radiofrequency neurotomy, randomized trials, systematic review, meta-analysis).

Data Selection

Two review authors (LM and ADK) independently developed the search criteria, conducted the literature search, and extracted data from the selected studies. Any disagreements between the two authors were resolved through consultation with a third author (MRS). To address potential conflicts of interest involving reviewers who are also co-authors of this article, such disputes were reassigned to independent reviewers for resolution.

Study of Risk of Bias and Methodological Quality Assessment

The included RCTs were evaluated for methodological quality and risk of bias using two established criteria: the Cochrane Review Criteria (Appendix Table 1) (55) and the Interventional Pain Management Techniques – Quality Appraisal of Reliability and Risk of Bias Assessment (IPM-QRB) (Appendix Table 2) (56).

Trials that met the inclusion criteria and received a score of 9 or higher out of 13 based on the Cochrane review criteria (55) were classified as high quality. Trials scoring between 5 and 8 were categorized as moderate quality, while those scoring below 5 were deemed low quality and excluded from the analysis.

All included trials were also evaluated using the IPM-QRB criteria (56). Studies scoring between 32 and 48 were considered high quality, those with scores from 16 to 31 were rated as moderate quality, and studies scoring below 16 were classified as low quality and excluded from the analysis.

Assessment Utilizing Grading of Recommendations, Assessment, Development and Evaluation (GRADE) Criteria

The Grading of Recommendations Assessment, Development and Evaluation (GRADE) framework is a transparent and systematic approach for summarizing evidence and formulating clinical practice recommendations (57,58). It is the most widely adopted tool for assessing the quality of evidence and guiding recommendations in healthcare.

GRADE categorizes evidence into four levels of certainty—also referred to as the quality of evidence: very low, low, moderate, and high, as outlined in Table 1. The certainty of evidence is determined by factors such as risk of bias, imprecision, inconsistency, indirectness, and publication bias. These factors may lead to increasing or decreasing confidence in the evidence. The reasons for upgrading or downgrading the certainty of evidence are summarized in Table 2.

Table 1. *GRADE certainty ratings*.

Certainty	What it means
Very low	The true effect is probably markedly different from the estimated effect
Low	The true effect might be markedly different from the estimated effect
Moderate	The authors believe that the true effect is probably close to the estimated effect
High	The authors have a lot of confidence that the true effect is similar to the estimated effect

Source: BMJ Best Practice. Evidence-based medicine (EBM) toolkit. Learn EBM. What is GRADE? Accessed 08/20/2024. https://bestpractice.bmj.com/info/us/toolkit/learn-ebm/what-is-grade/ (58)

The methodological quality of the trials and GRADE appraisal were independently conducted by two authors (LM and ADK) in an unblinded manner. In cases of disagreement, a third author (MRS) was consulted to resolve the conflict. When a conflict of interest related to study authorship was identified, the involved authors were excluded from the quality assessment of those specific studies.

Outcome Measures

An outcome was considered clinically significant if there was a reduction of 2 points on the Visual Analog Scale (VAS) or Numeric Rating Scale (NRS), or at least a 50% reduction in pain accompanied by improvement in functional status. A study was deemed positive and effective if the primary outcome was statistically significant, defined as $P \leq 0.05$.

Table 3 presents the strength of recommendations based on the National Guideline Clearinghouse Extent Adherence to Trustworthy Standards (NEATS) instrument (59), as modified by the guideline panel (9,11).

Analysis of Evidence

The evidence was evaluated using both qualitative and quantitative synthesis methods. Quantitative synthesis was conducted through conventional meta-analysis as well as single-arm meta-analysis approaches.

Qualitative Analysis

The qualitative analysis of the evidence was conducted using a modified best-evidence synthesis approach, incorporating multiple criteria, including the Cochrane Review criteria and the United States Preventive Services Task Force (USPSTF) criteria, as shown in Table 4 (60). The analysis categorized evidence into five levels, ranging from strong evidence to opinion- or consensus-based evidence.

Quantitative Analysis

Dual-Arm Meta-Analysis

For the dual-arm meta-analysis, Review Manager [Computer program], version 5.4, The Cochrane Collaboration, 2020, was used. Pain and functional improve-

ment outcomes were reported as standardized mean differences (SMD) with 95% confidence intervals (CI). Forest plots were generated to illustrate treatment effects using a random-effects model. Heterogeneity was assessed using the I^2 statistic.

Single-Arm Meta-Analysis

For the single-arm meta-analysis, Comprehensive Meta-Analysis software, version 3.0 (Biostat Inc., Englewood, NJ), was utilized. Pain and functional improvement outcomes were reported as mean differences

Table 2. *Reasons rate certainty in evidence up or down.*

Certainty can be rated down for:	Certainty can be rated up for:
• Risk of bias • Imprecision • Inconsistency • Indirectness • Publication bias	• Large magnitude of effect • Dose-response gradient • All residual confounding would decrease magnitude of effect (in situations with an effect)

Source: BMJ Best Practice. Evidence-based medicine (EBM) toolkit. Learn EBM. What is GRADE? Accessed 08/20/2024. https://bestpractice.bmj.com/info/us/toolkit/learn-ebm/what-is-grade/ (58)

Table 3. *Guide for strength of recommendations as modified for American Society of Interventional Pain Physicians (ASIPP) guidelines.*

Rating for Strength of Recommendation	
Strong	There is high confidence that the recommendation reflects best practice. This is based on: a) strong evidence for a true net effect (e.g., benefits exceed harms); b) consistent results, with no or minor exceptions; c) minor or no concerns about study quality; and/or d) the extent the panelists' agreement. Other compelling considerations (discussed in the guideline's literature review and analyses) may also warrant a strong recommendation. ASIPP Adaptation: Consensus was achieved that there is high certainty that the net benefit is substantial providing strong recommendation. Recommendation: Strong
Moderate	There is moderate confidence that the recommendation reflects best practice. This is based on: a) good evidence for a true net effect (e.g., benefits exceed harms); b) consistent results, with minor and/or few exceptions; c) minor and/or few concerns about study quality; and/or d) the extent of panelists' agreement. Other compelling considerations (discussed in the guideline's literature review and analyses) may also warrant a moderate recommendation. ASIPP Adaptation: Consensus was achieved that there is high certainty that the net benefit is moderate or there is moderate certainty that the net benefit is moderate to substantial. Recommendation: Moderate
Weak	There is some confidence that the recommendation offers the best current guidance for practice. This is based on: a) limited evidence for a true net effect (e.g., benefits exceed harms); b) consistent results, but with important exceptions; c) concerns about study quality; and/or d) the extent of panelists' agreement. Other considerations (discussed in the guideline's literature review and analyses) may also warrant a weak recommendation. ASIPP Adaptation: The consensus achieved that there is potential improvement in certain individuals or groups of patients based on individual professional judgement and shared decision making. Recommendation: Weak

Adapted and modified from: Jue JJ, et al. Developing and Testing the Agency for Healthcare Research and Quality's National Guideline Clearinghouse Extent of Adherence to Trustworthy Standards (NEATS) Instrument. *Ann Intern Med* 2019; 170:480-487 (59).

Table 4. *Qualitative modified approach to grading of evidence of therapeutic effectiveness studies.*

Level I	Strong	Evidence obtained from multiple relevant high-quality randomized controlled trials
Level II	Moderate	Evidence obtained from at least one relevant high-quality randomized controlled trial or multiple relevant moderate or low-quality randomized controlled trials
Level III	Fair	Evidence obtained from at least one relevant moderate or low-quality randomized trial OR Evidence obtained from at least one relevant high-quality non-randomized trial or observational study with multiple moderate or low-quality observational studies
Level IV	Limited	Evidence obtained from multiple moderate or low-quality relevant observational studies
Level V	Consensus based	Opinion or consensus of large group of clinicians and/or scientists

Modified from: Manchikanti L, et al. A modified approach to grading of evidence. *Pain Physician* 2014; 17:E319-E325 (60).

with 95% CI. Forest plots were used to display treatment effects, and heterogeneity was evaluated using the I^2 statistic.

Summary of Evidence

The evidence was synthesized using qualitative analysis and assessed according to GRADE criteria.

At least two review authors (LM and ADK) independently analyzed the evidence in a standardized manner. Any disagreements were resolved by a third author (MRS) through consensus. In cases involving potential conflicts of interest, such as authorship, the reviewers in question were recused from the assessment and analysis process.

Results

Study Selection

Figure 1 presents the study selection flow diagram following the PRISMA 2020 guidelines (47), illustrating the process used to identify, screen, and include studies in the review.

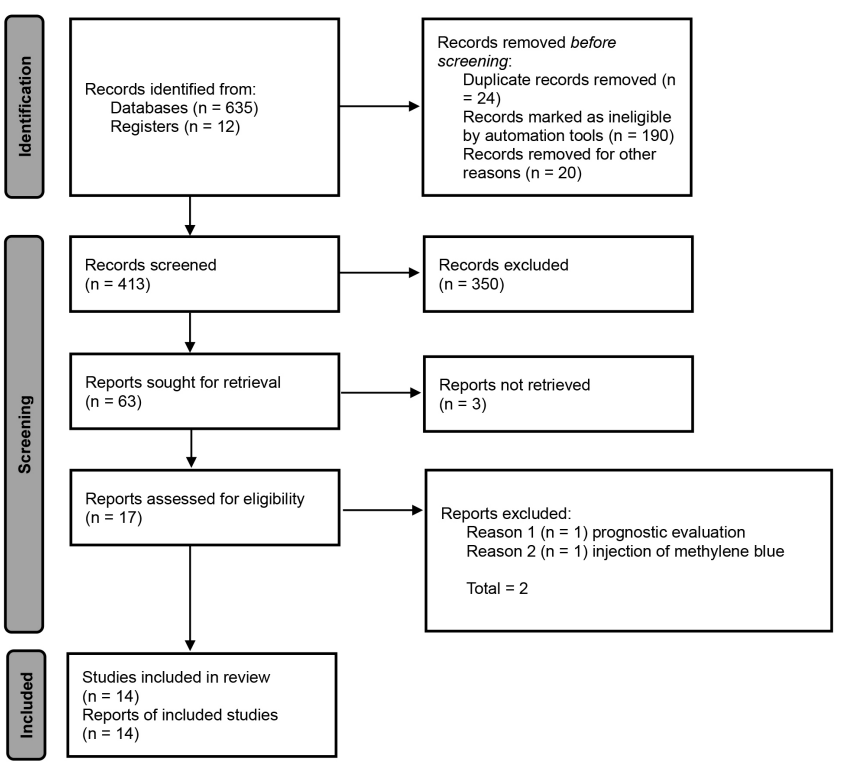

Fig. 1. *Flow diagram illustrating the literature used for evaluating intraarticular injections of facet joints.*

Based on the defined search criteria, a total of 17 randomized controlled trial (RCT) publications were identified (43,61-76), of which 14 trials met the inclusion criteria (43,61-65,68-74,76). The study by Kennedy et al (66) was excluded as it involved a prognostic evaluation prior to radiofrequency neurotomy and reported only 6 weeks of relief. Additionally, Kennedy et al (67) was excluded as it included the same patient population as the earlier study (66). The study by Yu et al (75) was excluded because it investigated the injection of methylene blue, which did not meet the inclusion criteria.

Methodologic Quality and Risk of Bias Assessment

Tables 5 and 6 present the methodological quality assessment and risk of bias for the 14 included RCTs (43,61-65,68-74,76), evaluated using both the Cochrane review criteria and the IPM-QRB criteria. According to the Cochrane review criteria, 12 trials were rated as high quality, each scoring at least 9 out of 13 (43,61,62,64,65,68,69,71-74,76), while 2 trials were rated as moderate quality, with scores ranging from 5 to 8 (63,70). Using the IPM-QRB instrument, 11 of the 14 trials were classified as high quality, each scoring above 32 out of 48 (43,61,62,64,65,68,69,71-74). The remaining 3 trials were rated as moderate quality, with scores between 16 and 31 (63,70,76).

Study Characteristics

Table 7 presents the study characteristics and outcomes of the trials that met the inclusion criteria.

Quantitative Analysis

An initial attempt was made to conduct a conventional or dual-arm meta-analysis; however, this was not feasible. As a result, only a single-arm meta-analysis was performed.

Single Arm Analysis

Pain Relief –3-Month Follow-Up

Figure 2A shows the results of a single meta-analysis utilizing active control with triam-

cinolone. There were 3 trials (62,71,76) used to assess pain scores at 3 months using NRS. As shown in Fig. 2A, the pooled mean difference of pain scores from the baseline to 3-month follow-up was 2.769 points decreased (95% CI: -3.273 to -2.266, $P = 0.804$).

Figure 2B shows the results of a single meta-analysis utilizing active control with dexamethasone. There were 3 trials (61,64,72) used to assess pain scores at 3 months using NRS. As shown in Fig. 2B, the pooled mean difference of pain scores from the baseline to 3-month follow-up was 2.510 points decreased (95% CI: -3.177 to -1.843, $P = 0.054$).

Pain Relief –6-Month Follow-Up

Figure 3A shows the results of a single meta-analysis utilizing active control with triamcinolone. There were 4 trials (62,63,74,76) used to assess pain scores at 6 months using NRS. As shown in Fig. 3A, the pooled mean difference of pain scores from the baseline to 6-month follow-up was 3.604 points decreased (95% CI: -5.578 to -1.630, $P < 0.001$).

Figure 3B shows

Table 5. *Methodological quality assessment of randomized trials of spinal facet joint intraarticular injections utilizing Cochrane review criteria.*

	Lee et al, 2018 (61)	Annaswamy et al, 2018 (62)	Carette et al, 1991 (43)	Fuchs et al, 2005 (63)	Do et al, 2017 (64)	Wu et al, 2017 (65)	Lakemeier et al, 2013 (68)	Barnsley et al, 1994 (69)	Park & Kim, 2012 (70)	Ribeiro et al, 2013 (71)	Allison et al, 2024 (72)	Kotb et al, 2022 (73)	Anshul et al, 2023 (74)	McCormick et al, 2023 (76)
Randomization adequate	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y
Concealed treatment allocation	Y	Y	Y	N	N	Y	Y	Y	N	Y	Y	Y	Y	Y
Patient blinded	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y
Care provider blinded	N	Y	Y	N	N	Y	N	Y	N	N	Y	N	N	N
Outcome assessor blinded	Y	Y	Y	Y	Y	Y	N	Y	N	N	Y	N	N	N
Drop-out rate described	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
All randomized participants analyzed in the group	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Reports of the study free of suggestion of selective outcome reporting	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Groups similar at baseline regarding most important prognostic indicators	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Co-intervention avoided or similar in all groups	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Compliance acceptable in all groups	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y	Y
Time of outcome assessment in all groups similar	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Are other sources of potential bias not likely	Y	N	N	U	U	Y	U	Y	U	U	Y	Y	Y	Y
SCORE	12/13	12/13	11/13	8/13	10/13	13/13	9/13	13/13	6/13	10/13	13/13	11/13	11/13	11/13

Y = yes; N = no; U = nuclear

Source: Furlan AD, et al; Editorial Board of the Cochrane Back, Neck Group. 2015 Updated Method Guideline for Systematic Reviews in the Cochrane Back and Neck Group. *Spine (Phila Pa 1976)* 2015; 40:1660-1673 (55).

Table 6. *Methodologic quality assessment of randomized trials of spinal facet joint nerve blocks utilizing IPM – QRB criteria.*

		Lee et al, 2018 (61)	Annaswamy et al, 2018 (62)	Carette et al, 1991 (43)	Fuchs et al, 2005 (63)	Do et al, 2017 (64)	Wu et al, 2017 (65)	Lakemeier et al, 2013 (68)	Barnsley et al, 1994 (69)
I.	TRIAL DESIGN AND GUIDANCE REPORTING								
1.	CONSORT or SPIRIT	2	2	3	3	2	2	2	2
II.	DESIGN FACTORS								
2.	Type and Design of Trial	2	2	3	2	2	2	2	2
3.	Setting/Physician	2	2	1	1	2	3	1	2
4.	Imaging	3	3	3	2	3	3	3	3
5.	Sample Size	1	1	2	2	1	2	2	1
6.	Statistical Methodology	1	1	1	1	1	1	1	1
III.	PATIENT FACTORS								
7.	Inclusiveness of Population								
	• For facet joint interventions:	2	1	1	0	2	0	1	2
8.	Duration of Pain	2	1	2	1	2	2	2	2
9.	Previous Treatments	2	2	0	0	1	2	2	0
10.	Duration of Follow-up with Appropriate Interventions	2	1	2	1	1	1	2	1
IV.	OUTCOMES								
11.	Outcomes Assessment Criteria for Significant Improvement	2	2	4	2	2	2	2	2
12.	Analysis of all Randomized Participants in the Groups	2	2	2	2	2	2	2	2
13.	Description of Drop Out Rate	2	2	1	2	2	2	2	1
14.	Similarity of Groups at Baseline for Important Prognostic Indicators	2	2	2	2	2	2	2	2
15.	Role of Co-Interventions	1	1	0	0	1	1	1	0
V.	RANDOMIZATION								
16.	Method of Randomization	2	2	2	2	2	2	2	2
VI.	ALLOCATION CONCEALMENT								
17.	Concealed Treatment Allocation	2	2	2	1	1	2	2	2
VII.	BLINDING								
18.	Patient Blinding	1	1	1	0	1	1	1	1
19.	Care Provider Blinding	1	1	1	0	0	1	0	1
20.	Outcome Assessor Blinding	1	1	1	0	1	1	0	1
VIII.	CONFLICTS OF INTEREST								
21.	Funding and Sponsorship	2	0	3	1	1	0	2	3
22.	Conflicts of Interest	2	1	3	1	1	2	3	3
TOTAL		39/48	33/48	40/48	26/48	33/48	36/48	37/48	36/48

Table 6 cont. *Methodologic quality assessment of randomized trials of spinal facet joint nerve blocks utilizing IPM – QRB criteria.*

		Park & Kim, 2012 (70)	Ribeiro et al, 2013 (71)	Allison et al, 2024 (72)	Kotb et al, 2022 (73)	Anshul et al, 2023 (74)	McCormick et al, 2023 (76)
I.	TRIAL DESIGN AND GUIDANCE REPORTING						
1.	CONSORT or SPIRIT	1	2	3	2	2	2
II.	DESIGN FACTORS						
2.	Type and Design of Trial	2	2	2	2	2	2
3.	Setting/Physician	2	2	3	3	3	3
4.	Imaging	3	3	3	3	3	3
5.	Sample Size	3	2	2	2	2	1
6.	Statistical Methodology	1	1	1	1	1	1
III.	PATIENT FACTORS						
7.	Inclusiveness of Population						
	• For facet joint interventions:	2	0	2	0	0	2
8.	Duration of Pain	2	0	2	2	2	2
9.	Previous Treatments	2	0	2	2	2	2
10.	Duration of Follow-up with Appropriate Interventions	2	1	1	1	1	2
IV.	OUTCOMES						
11.	Outcomes Assessment Criteria for Significant Improvement	1	2	2	2	2	2
12.	Analysis of all Randomized Participants in the Groups	1	2	2	2	2	2
13.	Description of Drop Out Rate	1	2	2	2	2	2
14.	Similarity of Groups at Baseline for Important Prognostic Indicators	2	2	2	2	2	2
15.	Role of Co-Interventions	0	1	2	1	1	1
V.	RANDOMIZATION						
16.	Method of Randomization	0	2	2	1	2	2
VI.	ALLOCATION CONCEALMENT						
17.	Concealed Treatment Allocation	0	2	2	1	1	2
VII.	BLINDING						
18.	Patient Blinding	0	1	1	1	1	1
19.	Care Provider Blinding	0	0	1	0	0	0
20.	Outcome Assessor Blinding	0	0	1	0	0	0
VIII.	CONFLICTS OF INTEREST						
21.	Funding and Sponsorship	1	2	0	0	0	-2
22.	Conflicts of Interest	1	3	2	2	2	-2
TOTAL		27/48	32/48	40/48	32/48	33/48	30/48

Source: Manchikanti L, et al. Assessment of methodologic quality of randomized trials of interventional techniques: Development of an interventional pain management specific instrument. *Pain Physician* 2014; 17:E263-E290 (56).

Table 7. *Study characteristics of randomized controlled trials assessing spinal facet joint intraarticular injections.*

Study **Study Characteristic** **Methodological Quality Scoring**	**Number of Patients & Selection Criteria**	**Facet Joint Intraarticular Injections**	**Comparator**	**Outcome Measures and Time of Measurement**	**Results**	**Strengths**	**Weaknesses**	**Conclusions**
LUMBAR FACET JOINT INTRAARTICULAR INJECTIONS								
Annaswamy et al, 2018 (62) DB, RA, AC Quality Scores: Cochrane = 12/13 IPM-QRB = 33/48	n = 30 Patients were randomly assigned to receive bilateral L3 to S1 lumbar facet joint injections with triamcinolone or Synvisc 1 Selection Criteria: • Clinical diagnosis • No diagnostic blocks performed	Intraarticular injection of Synvisc 1, 8 mg of hyaluronidase into each joint for a total volume of 6 mL injected per patient	Intraarticular injection of triamcinolone, 10 mg per mL into each joint with a total volume of 6 mL	VAS and functional status PDQ were collected at 1, 3, and 6 months after the procedure 1 month, 3 months, and 6 months	• Statistically significant changes in pain relief were noted in the hyaluronidase group only at 1 month • Functional disability scores significant improvement in steroid group at one month • Patients in hyaluronidase group showed significant improvement from baseline to 1 month, 3 months, and 6 months. Overall, hyaluronidase group appears to be superior to intraarticular steroid injection without local anesthetic	Randomized, double-blind, active-controlled trial	Active control trial in a small number of patients No diagnostic blocks utilized Outcomes of intraarticular triamcinolone injection showed lack of response due to triamcinolone group may be due to lack of local anesthetic	Negative trial The study shows lack of effectiveness of intraarticular steroid alone The response with hyaluronidase was only a month in reference to the pain relief
Carette et al, 1991 (43) RA, DB, impure placebo or AC Quality Scores: Cochrane = 11/13 IPM-QRB = 40/48	n = 97 Patients with chronic low back pain who reported immediate relief of their pain after injection of local anesthetic into the facet joints Patients were randomly assigned into 2 groups Selection Criteria: Single diagnostic blocks with 50% relief were randomly assigned to receive injections under fluoroscopic guidance	n =49 One injection of methylprednisolone into the facet joints Only one injection was provided	n =48 One intraarticular injection of isotonic saline	VAS, MPQ, mean SIP One, 3, and 6 months	After one month, 42% of the patients in the methylprednisolone group and 33% in the sodium chloride group reported marked or very marked improvement At the 6-month evaluation, 46% in the methylprednisolone group and 15% in the placebo group showed sustained relief Revised statistics showed 22% improvement in active group and 10% in control group	Well-performed randomized, double-blind controlled trial	Only single block was applied and patients were treated with steroids without local anesthetic with only one treatment and expected 6 months of relief	Negative trial The authors concluded that results were negative with injection of either sodium chloride solution or steroid into the facet joints after diagnosis with a single block

Table 7 cont. *Study characteristics of randomized controlled trials assessing spinal facet joint intraarticular injections.*

Study **Study Characteristic** **Methodological Quality Scoring**	**Number of Patients & Selection Criteria**	**Facet Joint Intraarticular Injections**	**Comparator**	**Outcome Measures and Time of Measurement**	**Results**	**Strengths**	**Weaknesses**	**Conclusions**
Fuchs et al, 2005 (63) RA, DB, AC Quality Scores: Cochrane = 8/13 IPM-QRB = 26/48	n = 60 60 patients with chronic low back pain were included with patients randomly assigned into 2 groups Selection Criteria: • Clinical trial group • No diagnostic block performed	Intraarticular glucocorticoid injection	Intraarticular injection of hyaluronic acid	VAS, RMDQ, ODI, LBOS, SF-36 3 months and 6 months	Patients reported lasting pain relief, better function, and improved quality of life with both treatments	Randomized, active-control, double-blind study	Relatively small sample of patients with 6-month follow-up without a placebo group, without diagnostic blocks	Indeterminate Undetermined (clinically inapplicable) results with high number of injections during a 6-month period
Do et al, 2017 (64) RA, DB, AC Quality Scores: Cochrane = 10/13 IPM-QRB = 33/48	n = 60 Patients with lumbar facet joint pain were randomly assigned to 1 of 2 groups Selection Criteria: • Clinical diagnosis • No diagnostic block performed	Group 2 Intraarticular injection of corticosteroid with 0.3 mL of contrast, 10 mg (0.25 mL of dexamethasone mixed with 0.25 mL of 0.125% bupivacaine) using a 26-gauge, 90 mm spinal needle. Intraarticular injection was successful in all 30 patients in the intraarticular injection group	Intraarticular pulsed radiofrequency neurotomy Pulsed radiofrequency was performed after placing a 23-gauge cannula with a 10 mm active tip inside the joint, followed by injection of 0.3 mL of contrast with pulsed radiofrequency for 360 seconds at 55 volts at temperature no exceeding 42° F	Blinded outcome measures were performed utilizing Pain intensity & NRS Successful outcome was defined as 50% reduction in the NRS scores at 6 months compared with pre-treatment scores Outcomes were measured before treatment, 2 weeks, 1, 3, and 6 months after treatment 3 months and 6 months	Analysis of improvement between the 2 groups showed a significant decrease in NRS scores at 2 weeks, and 1, 3, and 6 months after each treatment PRF was superior at 2 weeks At 3 and 6 months after the procedure, the decrements of NRS scores were not significantly different between the groups Six months after treatment, 50% of the patients in both groups reported successful pain relief of 50% or greater	Randomized, double-blind, active control trial	Active control trial with small number of patients No diagnostic blocks utilized Intraarticular pulsed radiofrequency is not an approved technique at the present time to treat facet joint pain	Positive trial This study shows that a single intraarticular injection may be effective for 6 months in 50% of the patients

Table 7 cont. *Study characteristics of randomized controlled trials assessing spinal facet joint intraarticular injections.*

Study **Study Characteristic** **Methodological Quality Scoring**	**Number of Patients & Selection Criteria**	**Facet Joint Intraarticular Injections**	**Comparator**	**Outcome Measures and Time of Measurement**	**Results**	**Strengths**	**Weaknesses**	**Conclusions**
Lakemeier et al, 2013 (68) RA, DB, AC Quality Scores: Cochrane = 9/13 IPM-QRB = 37/48	n = 56 Patients were randomized into 2 groups receiving intraarticular steroid injections or radiofrequency denervation after the diagnosis was made with intraarticular injection of local anesthetic (0.5 mL of bupivacaine) with a single block	n = 29 Intraarticular injection of local anesthetic 0.5 mL of 0.5% bupivacaine and 1 mL of betamethasone 3 mg was injected into the target joint after placing the radiofrequency needle with confirmation with contrast.	n = 27 Radiofrequency denervation was performed after placing the 20-gauge curved RF needle with 10 mm active tip after confirmation of correct placement using electrostimulation, followed by injection of 1 mL of 0.5% bupivacaine through the cannula	RMDQ, VAS, ODI, analgesic intake 6 months	Pain relief and functional improvement were observed in both groups There were no significant differences between the 2 groups for pain relief and functional status improvement Radiofrequency ablation had a lower VAS than patients after steroid injection after 6 months The decrease in VAS appears to be less than 2 in steroid group and approximately 2.5 or 3 points in radiofrequency group. Consequently, it is not known the clinical significance of the results as they have not provided clear results.	Lack of placebo group. Relatively short-term follow-up	Single diagnostic block with intraarticular injection Presentation of the results was unclear with relief which is indeterminate of positive response	Indeterminate Even though both groups showed improvement, which was equivalent, it is difficult to determine how much clinical improvement was there.

Table 7 cont. *Study characteristics of randomized controlled trials assessing spinal facet joint intraarticular injections.*

Study **Study Characteristic** **Methodological Quality Scoring**	**Number of Patients & Selection Criteria**	**Facet Joint Intraarticular Injections**	**Comparator**	**Outcome Measures and Time of Measurement**	**Results**	**Strengths**	**Weaknesses**	**Conclusions**
Ribeiro et al, 2013 (71) RA, DB, AC Quality Scores: Cochrane = 10/13 IPM-QRB = 32/48	n = 60 Patients with a clinical diagnosis of facial joint syndrome were randomized into experimental and control groups. Selection Criteria: • Clinical diagnosis • No diagnostic block performed	n = 31 Intraarticular injection of 6 lumbar facet joints with a total of 120 mg of triamcinolone hexacetonide All procedures were performed under fluoroscopic guidance	n = 29 All patients received intramuscular injections of 1 mL (20 mg) of triamcinolone acetonide, 1 mL of lidocaine with a 30 x 8 needle on 6 surface points of the lumbar paravertebral musculature bilaterally with a total of 120 mg All procedures were performed under fluoroscopic guidance	Pain, VAS during extension of the spine, Likert scale, improvement percentage scale, RMDQ, SF-36, and accountability of medications taken One, 4, 12, & 24 weeks	Improvement "percentage" analysis at each time point, showed significant differences between the groups at week 7 and week 12. Improvement percentage was > 50% at all times in the experimental group with intraarticular steroids; however, significant difference was noted at 24 weeks only Clinically, in the experimental group at 12-week follow-up, VAS pain decreased from 7.0 to 4.7, whereas in the control group, it decreased from 6.8 to 6.1 With evaluation of VAS pain on extension, at 12-week follow-up, pain decreased from 6.8 to 5.1 in the experimental group, whereas it decreased from 6.5 to 6.4 in the control group	Randomized, double-blind controlled trial	Diagnostic blocks were not employed, thus, many patients without facet joint pain may have been included in this trial Excessive amount of steroids with 120 mg in each patient With the high dose steroids, it was difficult to assess the value of intraarticular injections VAS with pain on extension, also reduction in VAS pain and VAS pain on extension appear to be clinically insignificant	Indeterminate Even though overall intraarticular steroids showed better relief at 12-week follow-up, which was still clinically indeterminate, as VAS pain decreased from 7.0 to 4.7 in experimental group, and 6.8 to 6.1 in control group

Table 7 cont. *Study characteristics of randomized controlled trials assessing spinal facet joint intraarticular injections.*

Study **Study Characteristic** **Methodological Quality Scoring**	**Number of Patients & Selection Criteria**	**Facet Joint Intraarticular Injections**	**Comparator**	**Outcome Measures and Time of Measurement**	**Results**	**Strengths**	**Weaknesses**	**Conclusions**
Kotb et al, 2022 (73) P, RA, single-blind Quality Scores: Cochrane = 11/13 IPM-QRB = 32/48	n = 30 Patients with lumbar facet joint synovitis were randomly allocated into 2 groups Selection Criteria: • Imaging and clinical assessment • No diagnostic block performed	n = 15 Intraarticular injection of a mixture of 0.5% lidocaine and 5 mg/mL of betamethasone)	n = 15 Intraarticular injection of 0.5 mL of autologous PRP	VAS, RMDQ, ODI, functional disability questionnaires 3 months	Both groups showed a significant improvement in all mentioned parameters at follow-up after 3 months PRP injections promoted better performance in terms of MRI synovitis grade in all lumbar FJ levels compared to CS injection Significant decrease in the number of tender lumbar facet joints on palpation and percentage of tender facet joints was higher in PRP group Maximum active lumbar extension range of motion was higher in PRP group	RCT The study evaluated corticosteroids and autologous PRP in the treatment of synovitis and lumbar facet joint disease	Small sample size Active control Single blind Authors utilized 10% change in ODI as significant	Indeterminate Corticosteroid injections reduced pain and increased the function, along with PRP injections; however, the clinical significance may not be highly relevant as VAS decreased from 8.07 to 5.73 in corticosteroid group and 8.0 to 5.73 in PRP group Even though statistically significant and facet joint tenderness decreased with increased range of motion, the clinical relevance of decrease in pain and function remains questionable
Anshul et al, 2023 (74) P, single-blind, RA Quality Scores: Cochrane = 11/13 IPM-QRB = 33/48	n = 60 Patients with a medical evaluation and pain pattern consistent with lumbar facet joint pain were randomly allocated to two groups Selection Criteria: • Clinical evaluation • No diagnostic block performed	n = 30 Lumbar facet joint injection utilizing 2 mL drug solution comprising 0.25% bupivacaine plus 10 mg of triamcinolone was injected into each facet joint under fluoroscopic guidance	n = 30 Lumbar facet joint nerve block utilizing a 2 ml drug solution comprising 0.25% bupivacaine plus 10 mg of triamcinolone was administered under fluoroscopic guidance For each affected lumbar facet joint, two facet joint nerve blocks were done - first at the affected level and second at the immediate higher level	NRS, ODI, RMDQ 1, 3 & 6 months	There was a statistically significant improvement in pain score after injection in both groups ($p > 0.05$) The mean pain score in both groups remained less than two at all time intervals throughout the study period ($p > 0.05$) Excellent patient satisfaction was reported by the majority of the patients at different time intervals in both groups	RCT	Single-blinded Small sample size No diagnostic blocks were performed.	Positive trial Both lumbar facet joint injection and lumbar facet joint nerve block are safe and effective techniques for managing lower back pain patients. Both techniques provide adequate pain relief and disability improvement

Table 7 cont. *Study characteristics of randomized controlled trials assessing spinal facet joint intraarticular injections.*

Study **Study Characteristic** **Methodological Quality Scoring**	**Number of Patients & Selection Criteria**	**Facet Joint Intraarticular Injections**	**Comparator**	**Outcome Measures and Time of Measurement**	**Results**	**Strengths**	**Weaknesses**	**Conclusions**
Wu et al, 2017 (65) RA, AC Quality Scores: Cochrane = 13/13 IPM-QRB = 36/48	n = 46 Lumbar facet joint syndrome Biologic Used: PRP Group A = PRP Group B = LA with steroids Selection Criteria: • Clinical assessment • Single intraarticular injections • Radiographic evidence	n = 23 Intraarticular injection of corticosteroids	n = 23 Intraarticular injection of autologous PRP	Low back pain, VAS, RMDQ, ODI 1 week, 1, 2, 3, & 6 months	Both groups showed a significant improvement in all parameters at follow-up after 3 months PRP injections promoted better performance in terms of MRI synovitis grade in all lumbar facet joint levels compared to corticosteroid injections	RCT The first of its nature to study the role of PRP versus corticosteroids in the treatment of synovitis Multiple outcome parameters were utilized	A single blind study, with no placebo group There were no diagnostic blocks performed to accurately predict the diagnosis of facet joint pain Short-term follow-up	Positive trial The results show improvement in both groups Compared to corticosteroids, PRP intraarticular injections showed better results
McCormick et al, 2023 (76) P, RA, comparative Quality Scores: Cochrane = 11/13 IPM-QRB = 30/48	n = 32 Patients with chronic low back pain and confirmed facet joint pain with dual medial branch blocks 32 patients met eligible criteria out of 1,128 patients 32 patients were randomized into 2 groups with 12 patients undergoing intraarticular facet steroid injection, 12 patients undergoing facet intraarticular injection, and 20 patients undergoing cooled lumbar medial branch radiofrequency neurotomy	n = 12 Intraarticular facet steroid injection utilizing 0.5 mL of 40 mg/mL Kenalog and 0.5 mL of 2% preservative-free lidocaine per facet joint A maximum of 4 facet joints (two on each side) were injected for bilateral low back pain For unilateral low back pain, up to 3 facet joints were injected	n = 20 Cooled lumbar medial branch radiofrequency ablation performed for 165 seconds, with the RFA generator temperature set to 60C For bilateral low back pain, a maximum of four facet joints (two on each side) were denervated by cooled lumbar medial branch radiofrequency ablation For unilateral low back pain, a maximum of three facet joints were denervated by cooled lumbar medial branch radiofrequency ablation	NRS, ODI, PGIC 1, 3, 6, & 12 months	In the cooled lumbar medial branch radiofrequency ablation group, 70% (95% CI 48-85), 55% (95% CI 34-74), and 45% (95% CI 26-66) of participants met the NRS responder definition, compared to 25% (95% CI 9-53), 25% (95% CI 9-53), and 17% (95% CI 5-45) in the intraarticular facet steroid injection group at 3, 6, and 12 months, respectively (p = .014 at 3 months) The PGIC responder proportion was higher in the cooled lumbar medial branch radiofrequency ablation compared to intraarticular facet steroid injection group at 3 and 6 months (p < .05)	RCT with selection criteria of dual diagnostic blocks and 12-month follow-up	Small sample size Active control trial	Negative trial Of the 12 patients receiving intraarticular injections, only 25% of the patients reported significant improvement at 3 months. Intraarticular facet joint steroid injections were inferior to cooled radiofrequency neurotomy

Table 7 cont. *Study characteristics of randomized controlled trials assessing spinal facet joint intraarticular injections.*

Study **Study Characteristic** **Methodological Quality Scoring**	**Number of Patients & Selection Criteria**	**Facet Joint Intraarticular Injections**	**Comparator**	**Outcome Measures and Time of Measurement**	**Results**	**Strengths**	**Weaknesses**	**Conclusions**
CERVICAL FACET JOINT INTRAARTICULAR INJECTIONS								
Barnsley et al, 1994 (69) RA, DB, AC Quality Scores: Cochrane = 13/13 IPM-QRB = 36/48	n = 41 Patients with involvement of one or more cervical zygapophysial joints after automobile accidents with median duration of pain of 39 months were randomly assigned into 2 groups Selection Criteria: Diagnosis was established by dual diagnostic blocks under fluoroscopic guidance with positive relief considered as complete or definite	n = 21 Intraarticular injection of 5.7 mg betamethasone or 1 mL intraarticular bupivacaine	n = 20 Injection of intraarticular local anesthetic, 1 mL	VAS, MPQ, SCL, MPQ 1, 4, 8, 16 and 20 weeks after the injection	No significant difference in duration of pain relief Median duration of time to return of pain to 50% was 3 days in the steroid group and 3.5 days in the local anesthetic group	Randomized controlled trial	Small sample size Single block for diagnosis	Negative trial Active control trial Lack of effectiveness of local anesthetic and local anesthetic with steroid
Park & Kim, 2012 (70) RA, AC Quality Scores: Cochrane = 6/13 IPM-QRB = 27/48	n = 200 Patients were selected for therapeutic intraarticular injections if they were positive for facet joint pain utilizing dual diagnostic blocks with concordant 80% pain relief	n = 200 Intraarticular injections were performed with 0.5 mL of 1% lidocaine and 5 mg of triamcinolone and 187.5 international units of hyaluronidase Patients also received either OnabotulinumtoxinA or trigger point injections if they required; however, these were of a small number.	n = 200 Conservative management	Cervical range of motion, NRS for pain, comorbid tension type headache 3, 6, & 12 months	Patients receiving intraarticular injections on one occasion showed increased cervical range of motion, increased mean NRS pain reduction, and decreased incidence of combined tension-type headache compared with control group receiving conservative management during follow-up	Randomized controlled trial in a large population of patients	Not blinded Intraarticular injections were compared with conservative management The study was also confounded with multiple deficiencies including trigger point injections and OnabotulinumtoxinA injections in some patients with ≥ 20% withdrawal rate	Indeterminate The study showed effectiveness of intraarticular injections of steroids; however, there were multiple confounding factors including trigger point injections and botulinum toxin injections. Consequently, it is hard to identify to which modality of treatment relief can be attributed.

Table 7 cont. *Study characteristics of randomized controlled trials assessing spinal facet joint intraarticular injections.*

Study **Study Characteristic** **Methodological Quality Scoring**	**Number of Patients & Selection Criteria**	**Facet Joint Intraarticular Injections**	**Comparator**	**Outcome Measures and Time of Measurement**	**Results**	**Strengths**	**Weaknesses**	**Conclusions**
Allison et al, 2024 (72) RA, DB Quality Scores: Cochrane = 13/13 IPM-QRB = 40/48	n = 40 Patients with chronic facet joint neck pain were randomized to 2 groups to receive either intraarticular injections or low concentrate PRP Selection Criteria: • Clinical diagnosis • Dual cervical medial branch blocks	n = 19 Intraarticular corticosteroid injections with mixture of 0.5 mL normal saline and 0.5 mL of dexamethasone at each facet joint	n = 21 Intraarticular PRP injections with 1 mL of PRP per facet joint	NRS, PSEQ, NDI 1, 3, and 6 months	At 3 and 6 month follow-up, significant reductions were shown compared with baseline scores in both groups There was no significant difference in the proportion achieving 50% pain relief between the corticosteroid and PRP groups at 3 and 6 months NRS scores of pain intensity were 5.63 ± 1.46 at baseline and 4.89 ± 1.94 at 3-month follow-up PRP group was also similar with 6.24 ± 1.81 at baseline and 4.81 ± 2.77 at 3 months 50% pain relief was achieved in 21% of the patients, or 4 of 19 in the steroid group and 6 of 21 in PRP group	RCT	Active control with small sample size	Negative trial Even though authors concluded that both groups showed improvement from baseline, the clinically relevant outcomes showed improvement in only 21% of the patients

Table 7 cont. *Study characteristics of randomized controlled trials assessing spinal facet joint intraarticular injections.*

Study **Study Characteristic** **Methodological Quality Scoring**	**Number of Patients & Selection Criteria**	**Facet Joint Intraarticular Injections**	**Comparator**	**Outcome Measures and Time of Measurement**	**Results**	**Strengths**	**Weaknesses**	**Conclusions**
THORACIC FACET JOINT INTRAARTICULAR INJECTIONS								
Lee et al, 2018 (61) RA, AC Quality Scores: Cochrane = 12/13 IPM-QRB = 39/48	n = 40 Patients with thoracic facet joint pain were recruited and randomly assigned into 1 of the 2 groups, with intraarticular steroid injection or medial branch blocks, each with 20 patients The selection criteria was determined by positive response to a single thoracic medial branch block with 0.5 mL of 1% lidocaine	Intraarticular thoracic facet joint steroid injection. Intraarticular injection was performed with injection of 0.3 mL of contrast material into the thoracic facet joint space followed by 1 mg, 0.25 mL of dexamethasone, mixed with 0.5 mL of 0.25% bupivacaine.	For the thoracic medial branch blocks, 0.5 mL of 0.25% bupivacaine, mixed with 10 mg, 0.25 mL of dexamethasone was injected	NRS (successful treatment was defined as more than 50% reduction in the NRS score at 6 months, when compared to the pre-treatment NRS score), patient GPE 6 months	In both groups, the NRS scores at follow-up periods, 1, 3, and 6 months were significantly lower than the pre-treatment scores Changes in the NRS scores over time were not significantly different between groups 6 months after treatment, 65% of the patients in the intraarticular steroid group and 8 patients (40%) in the medial branch block group reported successful pain relief No significant differences were observed in the areas of successful pain relief at 6 months after the procedure The rates of patient satisfaction between the 2 groups were not statistically significant	First randomized, double-blind controlled trial comparing intraarticular thoracic facet joint steroid injections and thoracic medial branch blocks	Small study with short-term follow-up	Positive trial In intraarticular group, 65% of the patients showed significant improvement

AC = active control; CI = confidence interval; DB = double-blind; IPM-QRB = Interventional Pain Management techniques–Quality Appraisal of reliability and Risk of Bias Assessment; LA = local anesthetic; LBOS = low-back outcomes score; MPQ = McGill Pain Questionnaire; NRS = Numeric Rating Scale; NDI = Neck Disability Index; ODI = Oswestry Disability Index; P= prospective; PDQ = Pain Disability Questionnaire; PRF = platelet-rich fibrin; PGIC = Patient Global Impression of Change ; PRP = platelet-rich plasma; RA = randomized; RCT – randomized controlled trial; RMDQ = Roland-Morris Disability Questionnaire; SCL = Symptom Checklist; SF-36 = Short Form-36; SIP = Sickness Impact Profile; VAS = Visual Analog Scale

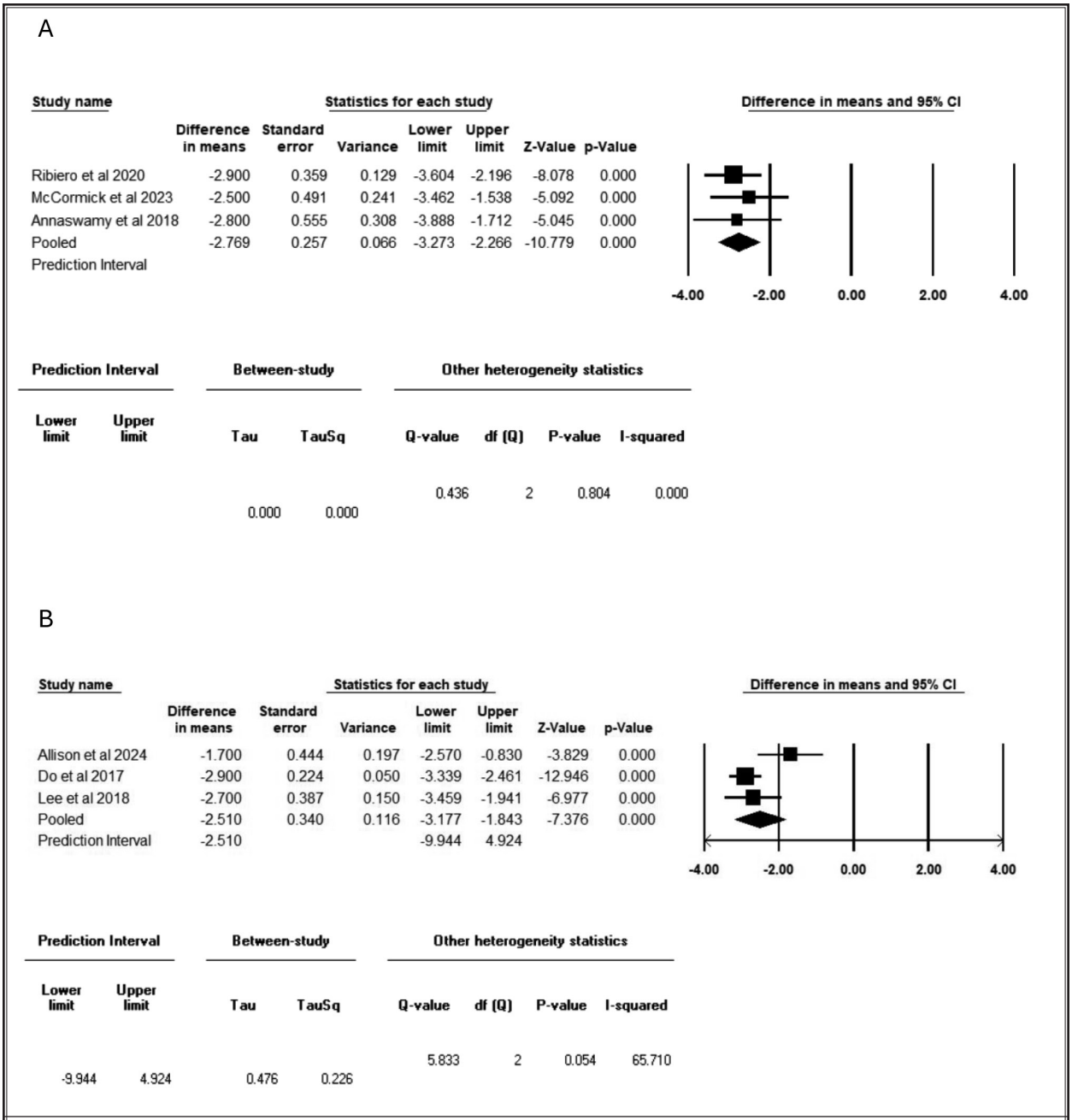

Fig. 2. *Results of pain relief at 3-month follow-up with intraarticular triamcinolone or dexamethasone.*
A. Outcomes of intraarticular injection of triamcinolone NRS at 3 months.
B. Outcomes of intraarticular injection of dexamethasone NRS at 3 months.

the results of a single meta-analysis utilizing active control with dexamethasone. There were 3 trials (61,64,72) used to assess pain scores at 6 months using NRS. As shown in Fig. 3B, the pooled mean difference of pain scores from the baseline to 6-month follow-up was 2.698 points decreased (95% CI: -3.394 to -2.002, P = 0.038).

While conventional dual-arm meta-analysis was not feasible, the single-arm analysis yielded modest results. At the 3-month follow-up, there was an average

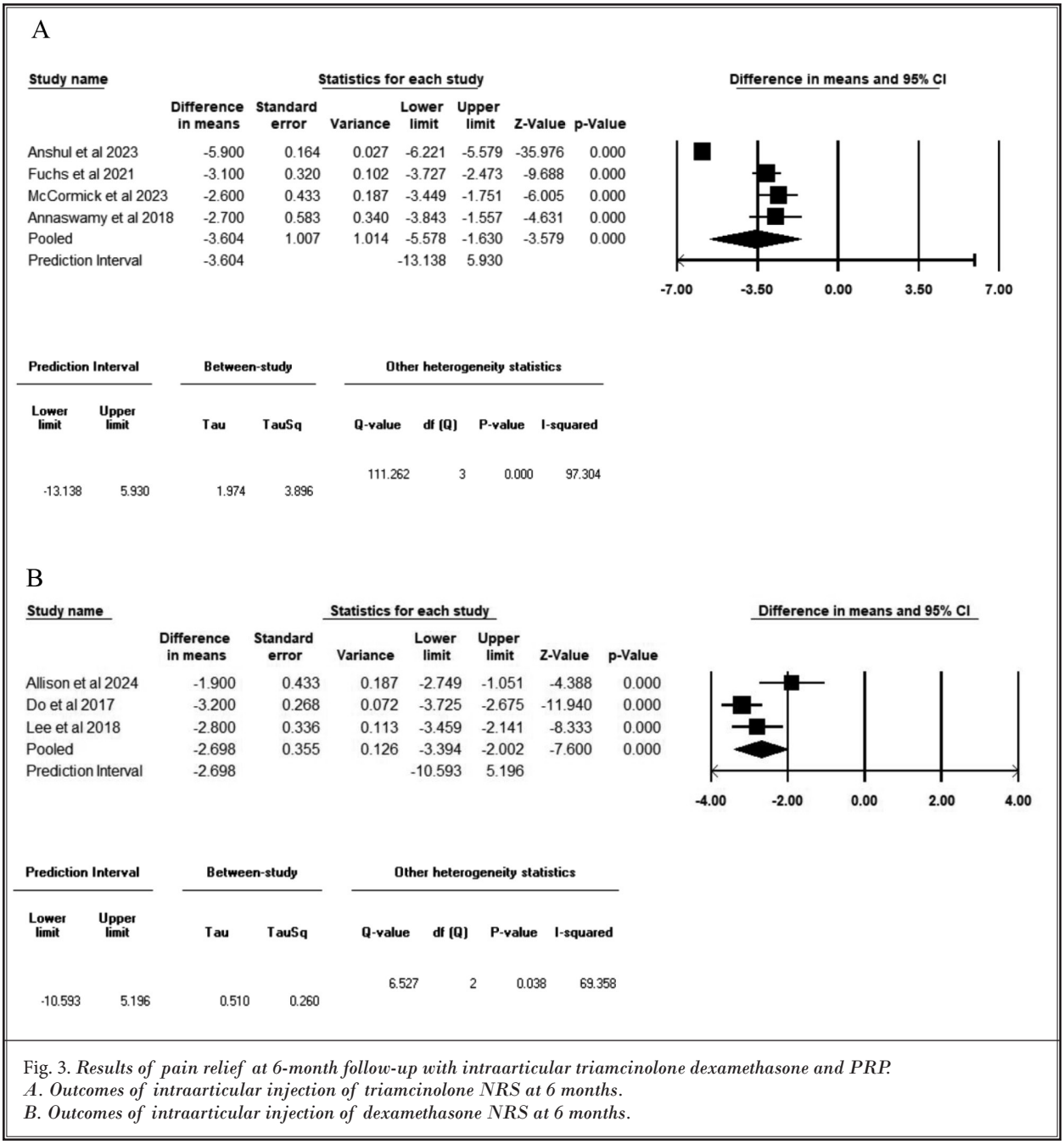

Fig. 3. *Results of pain relief at 6-month follow-up with intraarticular triamcinolone dexamethasone and PRP.*
A. Outcomes of intraarticular injection of triamcinolone NRS at 6 months.
B. Outcomes of intraarticular injection of dexamethasone NRS at 6 months.

reduction of 2.769 points in pain scores, with slightly greater improvement observed with triamcinolone, showing a 3.604-point decrease. Similarly, dexamethasone was associated with a 2.510-point reduction at 3 months and a 2.698-point reduction at 6 months. No significant differences were found between triamcinolone and dexamethasone. Additionally, only four trials met the eligibility criteria for inclusion in this analysis..

Qualitative Analysis

The evidence in this study was analyzed qualitatively using a best-evidence synthesis approach, incorporating multiple criteria, including the Cochrane Review and the USPSTF guidelines, as outlined in Table 4 (60). The analysis employed five levels of evidence, ranging from strong to opinion- or consensus-based. Results were graded using the GRADE system (59), with

the strength of recommendation categorized as strong, moderate, or weak (9,11).

The qualitative assessment was based on the number and quality of studies included. A total of 14 randomized controlled trials (RCTs) were analyzed (43,61-65,68-74,76). According to the Cochrane Review criteria, 12 trials were classified as high quality (43,61,62,64,65,68, 69,71-74,76), and 2 as moderate quality (63,70). Based on the IPM-QRB criteria, 11 trials were rated as high quality (43,61,62,64, 65,68,69,71-74), and 3 as moderate quality (63,70,76).

Among the 14 RCTs, 4 trials demonstrated positive outcomes (61,64,65,74), 5 were negative (43,62,69,72,76), and 5 were considered indeterminate (63,68,70,71,73).

As a result, the overall evidence is classified as Level IV, indicating limited evidence, with a low level of recommendation.

GRADE Assessment

Table 8 presents the GRADE assessment, which evaluates five key factors—methodologic limitations, consistency, indirectness, imprecision, and publication bias—across five levels of evidence, graded as high, moderate, low, or very low. According to the GRADE assessment, none of the included studies achieved a high level of certainty. Four studies demonstrated moderate certainty and impact (43,61,70,74), eight studies were rated as having low certainty and impact (62-65,68,69,73,76), and two studies showed low impact with very low certainty (71,72).

Summary of Evidence

Based on the combined qualitative and quantitative analysis and GRADE evidence synthesis, the overall summary of evidence is Level IV, indicating low certainty and low strength of recommendation.

Discussion

In the present analysis, a total of 14 randomized controlled trials (RCTs) were included (43,61-65,68-74,76). All studies underwent quality assessment using both the Cochrane review criteria and the IPM-QRB instrument. Applying a best-evidence synthesis approach, incorporating both qualitative and quantitative

Table 8. *Evidence profile using randomized controlled trials for spinal facet joint intraarticular injections for the same outcome and similar certainty of evidence.*

CERTAINTY ASSESSMENT									
Study	**Study Design**	**Risk of Bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Publication Bias**	**Number of Patients**	**Impact**	**Certainty**
Lee et al, 2018 (61)	RA, AC	Low	NS	NS	NS	Low	n = 40	Moderate	Moderate
Annaswamy et al, 2018 (62)	DB, RA, AC	Moderate	NS	NS	NS	Low	n = 30	Low	Low
Carette et al, 1991 (43)	RA, DB, impure placebo or AC	Moderate	NS	NS	NS	Low	n = 97	Moderate	Moderate
Fuchs et al, 2005 (63)	RA, DB, AC	Moderate	NS	NS	NS	Low	n = 60	Low	Low
Do et al, 2017 (64)	RA, DB, AC	Moderate	NS	NS	NS	Low	n = 60	Low	Low
Wu et al, 2017 (65)	RA, AC	Low	NS	NS	NS	Low	n = 46	Low	Low
Lakemeier et al, 2013 (68)	RA, DB, AC	Low	NS	NS	NS	Low	n = 56	Low	Low
Barnsley et al, 1994 (69)	RA, DB, AC	Low	NS	NS	NS	Low	n = 41	Low	Low
Park & Kim, 2012 (70)	RA, AC	Low	NS	NS	NS	Low	n = 200	Moderate	Moderate
Ribeiro et al, 2013 (71)	RA, DB, AC	Moderate	NS	NS	NS	Low	n = 60	Low	Very low
Allison et al, 2024 (72)	RA, DB	Low	NS	NS	NS	Low	n = 40	Low	Very low
Kotb et al, 2022 (73)	P, RA, single-blind	Low	NS	NS	NS	Low	n = 30	Low	Low
Anshul et al, 2023 (74)	P, single-blind, RA	Moderate	NS	NS	NS	Low	n = 60	Moderate	Moderate
McCormick et al, 2023 (76)	P, RA, comparative	Low	NS	NS	NS	Low	n = 32	Low	Low

AC = active controlled; DB = double-blind; NS = Not serious; P= prospective; PC = placebo controlled; RA = randomized

analysis along with the GRADE framework and clinical applicability criteria, the resulting evidence was found to be valuable, relevant, and clinically applicable.

Based on Cochrane review criteria, 12 trials were identified as high quality (43,61,62,64,65,68,69,71-74,76), and 2 as moderate quality (63,70). Using IPM-QRB criteria, 11 trials were rated as high quality (43,61,62,64,65,68,69,71-74), and 3 as moderate quality (63,70,76). According to GRADE assessment, only 4 trials demonstrated moderate levels of impact and certainty (43,61,70,74), 8 trials were graded as low (62-65,68,69,73,76), and 2 trials showed low impact with very low certainty (71,72).

The findings of this systematic review and limited meta-analysis are consistent with several previously published reviews (3,35,36,38,39,41,46,52).

Baroncini et al (35), in a 2021 systematic review on the management of facet joint osteoarthritis associated with chronic low back pain, included data from 487 patients across 8 studies with a mean follow-up of 12.4 ± 10.5 months. Using Cochrane methodological quality criteria, which showed overall low risk of bias, they concluded that medial branch blocks yielded more consistent results compared to intraarticular facet joint injections. Treatments using local anesthetics, corticosteroids, and Sarapin—individually or in combination—demonstrated improvements in both pain and disability scores.

Ambrosio et al (36) conducted a systematic review in 2021 of minimally invasive treatments for lumbar facet joint syndrome, including 18 studies with 1,496 patients. Interventions assessed included intraarticular hyaluronic acid and corticosteroid injections. Radiofrequency denervation demonstrated outcomes slightly superior or comparable to intraarticular corticosteroids, physical therapy, or sham procedures. Corticosteroids combined with oral diclofenac produced better outcomes than corticosteroids or diclofenac alone, but not better than local anesthetic plus Sarapin. However, the review misclassified facet joint nerve blocks as intraarticular injections, compromising the validity of their conclusions (37).

Appeadu et al (38) evaluated the effectiveness of intraarticular cervical facet steroid injections through a systematic review and meta-analysis. Only 3 studies with a total of 64 patients met inclusion criteria. While results suggested potential effectiveness for cervicogenic headache, the mean effect size on the visual analog scale (VAS) was 3.299, with 36.11% heterogeneity. Notably, no RCTs were included.

Ashmore et al (39) assessed ultrasound-guided lumbar medial branch blocks and intraarticular injections, focusing on needle placement accuracy. Their meta-analysis included several RCTs. Pooled results from 7 studies revealed an 11% rate of incorrect needle placement in ultrasound-guided medial branch blocks confirmed by fluoroscopy. Additionally, pooled data from 3 studies showed a 13% error rate for facet joint injections confirmed by CT. They concluded that the overall certainty of evidence was low to very low and that ultrasound guidance carries significant risk for incorrect needle placement.

Acosta Julbe et al (40), in a scoping review, examined predictors of outcomes for lumbar intraarticular facet injections and medial branch blocks. The review included 37 studies and identified key predictive factors such as imaging evidence of facet arthropathy, duration of symptoms, and positive single-photon emission computed tomography (SPECT) scans.

Suputtitada et al (41) conducted a systematic review and meta-analysis involving 3 studies evaluating intraarticular normal saline injections for chronic low back pain. The review concluded that normal saline produced pain relief comparable to that of active substances in both short- and long-term settings. The included studies—by Lilius et al (42), Carette et al (43), and Revel et al (44)—are well established in the literature. Their findings also showed that corticosteroid injections for cervical joint pain had a negative, though not statistically significant, effect on functional outcomes compared to radiofrequency neurotomy at 3-month follow-up.

Xu et al (45) compared radiofrequency ablation and corticosteroid injections for spinal facet and sacroiliac joint pain in a meta-analysis of 33 studies. Their findings showed greater pain relief with radiofrequency at 3 and 6 months, though no significant difference was observed at 12 months. For cervical facet pain, patients treated with corticosteroids had higher functional disability scores than those receiving radiofrequency ablation at 3 months, though the difference was not statistically significant.

Mazmudar et al (46) provided an economic evaluation of lumbar spine facet interventions, including intraarticular injections, medial branch blocks, and radiofrequency neurotomy. Their 2020 review concluded that while evidence for intraarticular injections was limited, moderate evidence supported the use of medial branch blocks and radiofrequency neurotomies.

The current systematic review, using a single-arm

meta-analysis, demonstrated Level IV evidence with low certainty and a low strength of recommendation, based on both qualitative and quantitative synthesis and GRADE evaluation.

Fogarty et al (52) recently reviewed fluoroscopically guided lumbar facet steroid injections. Their review included both randomized and observational studies but did not perform meta-analysis. They evaluated methodological quality and conducted GRADE assessments. Among the 21 included studies, success rates for ≥ 50% pain relief ranged from 13% to 74%. Functional improvement of ≥ 30% was reported at one month in only one study. Mean improvements ranged from 11% to 59% in pain and 8% to 58% in function. Subgroup analysis of studies using diagnostic blocks showed pain relief rates from 23% to 67% and functional improvement from 15% to 58% at one month. However, the overall quality of evidence was rated very low due to high risk of bias, study heterogeneity, and methodological inconsistencies.

In contrast, our prior systematic review on facet joint nerve blocks showed stronger evidence, including 8 high-quality and one moderate-quality RCT, and 8 high-quality and 4 moderate-quality non-randomized studies. GRADE assessment showed that 3 of the 21 studies had high levels of impact and certainty, and 11 had moderate levels. Overall, this review supported Level II evidence with moderate certainty and a moderate-to-strong recommendation for the use of facet joint nerve blocks in managing spinal facet joint pain.

Despite this, there remains a noticeable bias in favor of intraarticular injections over facet joint nerve blocks, even though the former lacks comparable evidence. Intraarticular injections are technically more challenging and more painful than nerve blocks. Notably, intraarticular injections have been associated with a high technical failure rate—ranging from 29% to 38% per joint, and 46% to 64% per procedure (77,78). Excessive procedural pain may also lead to false-negative results, while less painful procedures such as medial branch blocks may reduce the false-negative rate (25,79). Moreover, the technical failure rate is highest at the L5/S1 level for intraarticular injections. In contrast, lumbar medial branch blocks reliably target the intended nerve, despite a 4%–9% intravascular uptake rate, which can cause false negatives but is mitigated with appropriate fluoroscopic guidance (7,45).

The strengths of this review include a rigorous methodological quality assessment, comprehensive qualitative and quantitative synthesis, and integration of GRADE and clinical applicability criteria. The findings also reflect applicability to real-world clinical practice. The limitations include the small number of placebo-controlled trials and variability in technical procedures across studies.

Conclusion

The present systematic review and meta-analysis of therapeutic facet joint nerve blocks for the management of chronic axial spinal pain demonstrates Level IV evidence, indicating limited effectiveness, with a low level of certainty and a low strength of recommendation, based on the analysis of 14 RCTs.

According to the GRADE assessment, none of the included studies achieved a high level of certainty. Four studies demonstrated moderate impact and certainty (43,61,70,74), eight studies were rated as having low impact and certainty (62–65,68,69,73,76), and two studies were assessed as having low impact with very low certainty (71,72).

Author Contributions

The article was designed by LM, MRS and NNK.

Statistical analysis was performed by EK, AS and NNK.

All authors contributed to the preparation of the article, reviewed, and approved the content with the final version.

Acknowledgments

The authors wish to thank Tonie M. Hatton and Diane E. Neihoff, transcriptionists, for their assistance in the preparation of this article. We would like to thank the editorial board of Pain Physician for review and criticism in improving the article.

Supplemental material is available at www.painphysicianjournal.com

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Appendix Table 1. *Sources of risk of bias and Cochrane Review rating system.*

Bias Domain	**Source of Bias**		**Possible Answers**
Selection	(1) Was the method of randomization adequate?	A random (unpredictable) assignment sequence. Examples of adequate methods are coin toss (for studies with 2 groups), rolling a dice (for studies with 2 or more groups), drawing of balls of different colors, drawing of ballots with the study group labels from a dark bag, computer-generated random sequence, preordered sealed envelopes, sequentially-ordered vials, telephone call to a central office, and preordered list of treatment assignments.	Yes/No/Unsure
		Examples of inadequate methods are: alternation, birth date, social insurance/ security number, date in which they are invited to participate in the study, and hospital registration number.	
Selection	(2) Was the treatment allocation concealed?	Assignment generated by an independent person not responsible for determining the eligibility of the patients. This person has no information about the persons included in the trial and has no influence on the assignment sequence or on the decision about eligibility of the patient.	Yes/No/Unsure
Performance	(3) Was the patient blinded to the intervention?	Index and control groups are indistinguishable for the patients or if the success of blinding was tested among the patients and it was successful.	Yes/No/Unsure
Performance	(4) Was the care provider blinded to the intervention?	Index and control groups are indistinguishable for the care providers or if the success of blinding was tested among the care providers and it was successful.	Yes/No/Unsure
Detection	(5) Was the outcome assessor blinded to the intervention?	Adequacy of blinding should be assessed for each primary outcome separately. This item should be scored "yes" if the success of blinding was tested among the outcome assessors and it was successful or:	Yes/No/Unsure
		• for patient-reported outcomes in which the patient is the outcome assessor (e.g., pain, disability): the blinding procedure is adequate for outcome assessors if participant blinding is scored "yes"	
		• for outcome criteria assessed during scheduled visit and that supposes a contact between participants and outcome assessors (e.g., clinical examination): the blinding procedure is adequate if patients are blinded, and the treatment or adverse effects of the treatment cannot be noticed during clinical examination	
		• for outcome criteria that do not suppose a contact with participants (e.g., radiography, magnetic resonance imaging): the blinding procedure is adequate if the treatment or adverse effects of the treatment cannot be noticed when assessing the main outcome	
		• for outcome criteria that are clinical or therapeutic events that will be determined by the interaction between patients and care providers (e.g., cointerventions, hospitalization length, treatment failure), in which the care provider is the outcome assessor: the blinding procedure is adequate for outcome assessors if item "4" (caregivers) is scored "yes"	
		• for outcome criteria that are assessed from data of the medical forms: the blinding procedure is adequate if the treatment or adverse effects of the treatment cannot be noticed on the extracted data	
Attrition	(6) Was the drop-out rate described and acceptable?	The number of participants who were included in the study but did not complete the observation period or were not included in the analysis must be described and reasons given. If the percentage of withdrawals and drop-outs does not exceed 20% for short-term follow-up and 30% for long-term follow-up and does not lead to substantial bias a "yes" is scored (N.B. these percentages are arbitrary, not supported by literature).	Yes/No/Unsure
Attrition	(7) Were all randomized participants analyzed in the group to which they were allocated?	All randomized patients are reported/analyzed in the group they were allocated to by randomization for the most important moments of effect measurement (minus missing values) irrespective of noncompliance and cointerventions.	Yes/No/Unsure
Reporting	(8) Are reports of the study free of suggestion of selective outcome reporting?	All the results from all prespecified outcomes have been adequately reported in the published report of the trial. This information is either obtained by comparing the protocol and the report, or in the absence of the protocol, assessing that the published report includes enough information to make this judgment.	Yes/No/Unsure

Appendix Table 1 cont. *Sources of risk of bias and Cochrane Review rating system.*

Bias Domain	**Source of Bias**		**Possible Answers**
Selection	(9) Were the groups similar at baseline regarding the most important prognostic indicators?	Groups have to be similar at baseline regarding demographic factors, duration and severity of complaints, percentage of patients with neurological symptoms, and value of main outcome measure(s).	Yes/No/Unsure
Performance	(10) Were cointerventions avoided or similar?	If there were no cointerventions or they were similar between the index and control groups.	Yes/No/Unsure
Performance	(11) Was the compliance acceptable in all groups?	The reviewer determines if the compliance with the interventions is acceptable, based on the reported intensity, duration, number and frequency of sessions for both the index intervention and control intervention(s). For example, physiotherapy treatment is usually administered for several sessions; therefore it is necessary to assess how many sessions each patient attended. For single-session interventions (e.g., surgery), this item is irrelevant.	Yes/No/Unsure
Detection	(12) Was the timing of the outcome assessment similar in all groups?	Timing of outcome assessment should be identical for all intervention groups and for all primary outcome measures.	Yes/No/Unsure
Other	(13) Are other sources of potential bias unlikely?	Other types of biases. For example: • When the outcome measures were not valid. There should be evidence from a previous or present scientific study that the primary outcome can be considered valid in the context of the present. • Industry-sponsored trials. The conflict of interest (COI) statement should explicitly state that the researchers have had full possession of the trial process from planning to reporting without funders with potential COI having any possibility to interfere in the process. If, for example, the statistical analyses have been done by a funder with a potential COI, usually "unsure" is scored.	Yes/No/Unsure

Adapted and modified from: Furlan AD, et al; Editorial Board of the Cochrane Back, Neck Group. 2015 Updated method guideline for systematic reviews in the Cochrane Back and Neck Group. *Spine (Phila Pa 1976)* 2015; 40:1660-1673 (55).

Appendix Table 2. *Item checklist for assessment of randomized controlled trials of interventional pain management techniques utilizing IPM – QRB.*

		Scoring
I.	TRIAL DESIGN AND GUIDANCE REPORTING	
1.	CONSORT or SPIRIT	
	Trial designed and reported without any guidance	0
	Trial designed and reported utilizing minimum criteria other than CONSORT or SPIRIT criteria or trial was conducted prior to 2005	1
	Trial implies it was based on CONSORT or SPIRIT without clear description with moderately significant criteria for randomized trials or the trial was conducted before 2005	2
	Explicit use of CONSORT or SPIRIT with identification of criteria or trial conducted with high level reporting and criteria or conducted before 2005	3
II.	DESIGN FACTORS	
2.	Type and Design of Trial	
	Poorly designed control group (quasi selection, convenient sampling)	0
	Proper active-control or sham procedure with injection of active agent	2
	Proper placebo control (no active solutions into active structures)	3
3.	Setting/Physician	
	General setting with no specialty affiliation and general physician	0
	Specialty of anesthesia/PMR/neurology/radiology/ortho, etc.	1
	Interventional pain management with interventional pain management physician	2
4.	Imaging	
	Blind procedures	0
	Ultrasound	1
	CT	2
	Fluoro	3
5.	Sample Size	
	Less than 50 participants in the study without appropriate sample size determination	0
	Sample size calculation with less than 25 patients in each group	1
	Appropriate sample size calculation with at least 25 patients in each group	2
	Appropriate sample size calculation with 50 patients in each group	3
6.	Statistical Methodology	
	None or inappropriate	0
	Appropriate	1
III.	PATIENT FACTORS	
7.	Inclusiveness of Population	
7a.	For epidural procedures:	
	Poorly identified mixed population	0
	Clearly identified mixed population	1
	Disorders specific trials (i.e. well defined spinal stenosis and disc herniation, disorder specific, disc herniation or spinal stenosis or post surgery syndrome)	2
7b.	For facet or sacroiliac joint interventions:	
	No diagnostic blocks	0
	Selection with single diagnostic blocks	1
	Selection with placebo or dual diagnostic blocks	2
8.	Duration of Pain	
	Less than 3 months	0

Appendix Table 2 cont. *Item checklist for assessment of randomized controlled trials of interventional pain management techniques utilizing IPM – QRB.*

		Scoring
	3 to 6 months	1
	> 6 months	2
9.	Previous Treatments	
	Conservative management including drug therapy, exercise therapy, physical therapy, etc.	
	Were not utilized	0
	Were utilized sporadically in some patients	1
	Were utilized in all patients	2
10.	Duration of Follow-up with Appropriate Interventions	
	Less than 3 months or 12 weeks for epidural or facet joint procedures, etc. and 6 months for intradiscal procedures and implantables	0
	3 to 6 months for epidural or facet joint procedures, etc., or 1 year for intradiscal procedures or implantables	1
	6 months to 17 months for epidurals or facet joint procedures, etc., and 2 years or longer for discal procedures and implantables	2
	18 months or longer for epidurals and facet joint procedures, etc., or 5 years or longer for discal procedures and implantables	3
IV.	OUTCOMES	
11.	Outcomes Assessment Criteria for Significant Improvement	
	No descriptions of outcomes OR < 20% change in pain rating or functional status	0
	Pain rating with a decrease of 2 or more points or more than 20% reduction OR functional status improvement of more than 20%	1
	Pain rating with decrease of ≥ 2 points AND 20% change or functional status improvement of ≥ 20%	2
	Pain rating with a decrease of 3 or more points or more than 50% reduction OR functional status improvement with a 50% or 40% reduction in disability score	2
	Significant improvement with pain and function ≥ 50% or 3 points and 40% reduction in disability scores	4
12.	Analysis of all Randomized Participants in the Groups	
	Not performed	0
	Performed without intent-to-treat analysis without inclusion of all randomized participants	1
	All participants included with or without intent-to-treat analysis	2
13.	Description of Drop Out Rate	
	No description of dropouts, despite reporting of incomplete data or ≥ 20% withdrawal	0
	Less than 20% withdrawal in one year in any group	1
	Less than 30% withdrawal at 2 years in any group	2
14.	Similarity of Groups at Baseline for Important Prognostic Indicators	
	Groups dissimilar with significant influence on outcomes with or without appropriate randomization and allocation	0
	Groups dissimilar without influence on outcomes despite appropriate randomization and allocation	1
	Groups similar with appropriate randomization and allocation	2
15.	Role of Co-Interventions	
	Co-interventions were provided but were not similar in the majority of participants	0
	No co-interventions or similar co-interventions were provided in the majority of the participants	1
V.	RANDOMIZATION	
16.	Method of Randomization	
	Quasi randomized or poorly randomized or not described	0

Appendix Table 2 cont. *Item checklist for assessment of randomized controlled trials of interventional pain management techniques utilizing IPM – QRB.*

		Scoring
	Adequate randomization (coin toss, drawing of balls of different colors, drawing of ballots)	1
	High quality randomization (Computer generated random sequence, pre-ordered sealed envelopes, sequentially ordered vials, telephone call, pre-ordered list of treatment assignments, etc.)	2
VI.	ALLOCATION CONCEALMENT	
17.	Concealed Treatment Allocation	
	Poor concealment of allocation (open enrollment) or inadequate description of concealment	0
	Concealment of allocation with borderline or good description of the process with probability of failure of concealment	1
	High quality concealment with strict controls (independent assignment without influence on the assignment sequence)	2
VII.	BLINDING	
18.	Patient Blinding	
	Patients not blinded	0
	Patients blinded adequately	1
19.	Care Provider Blinding	
	Care provider not blinded	0
	Care provider blinded adequately	1
20.	Outcome Assessor Blinding	
	Outcome assessor not blinded or was able to identify the groups	0
	Performed by a blinded independent assessor with inability to identify the assignment-based provider intervention (i.e., subcutaneous injection, intramuscular distant injection, difference in preparation or equipment use, numbness and weakness, etc.)	1
VIII.	CONFLICTS OF INTEREST	
21.	Funding and Sponsorship	
	Trial included industry employees	-3
	Industry employees involved; high levels of funding with remunerations by industry or an organization funded with conflicts	-3
	Industry or organizational funding with reimbursement of expenses with some involvement	0
	Industry or organization funding of expenses without involvement	1
	Funding by internal resources only with supporting entity unrelated to industry	2
	Governmental funding without conflict such as NIH, NHS, AHRQ	3
22.	Conflicts of Interest	
	None disclosed with potential implied conflict	0
	Marginally disclosed with potential conflict	1
	Well disclosed with minor conflicts	2
	Well disclosed with no conflicts	3
	Hidden conflicts with poor disclosure	–1
	Misleading disclosure with conflicts	–2
	Major impact related to conflicts	–3
TOTAL		48

Source: Manchikanti L, et al. Assessment of methodologic quality of randomized trials of interventional techniques: Development of an interventional pain management specific instrument. *Pain Physician* 2014; 17:E263-E290 (56).