

## Systematic Review

# An Updated Review of the Diagnostic Utility of Cervical Facet Joint Injections

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**Background:** Chronic persistent neck pain with or without upper extremity pain is common in the general adult population with a prevalence of 48% for women and 38% for men, with persistent complaints in 22% of women and 16% of men. Multiple modalities of treatment are exploding in managing chronic neck pain along with increasing prevalence. However, there is a paucity of evidence for all modalities of treatments in managing chronic neck pain. Controlled studies have supported the existence of cervical facet or zygapophysial joint pain in 36% to 60% in heterogenous population of these patients. However, these studies also have shown false-positive results in 27% to 63% of patients with a single diagnostic block.

**Study Design:** A systematic review of diagnostic cervical facet joint nerve blocks.

**Objective:** To evaluate and update the accuracy of diagnostic facet joint nerve blocks in the diagnosis of facet joint pain.

**Methods:** A methodological quality assessment of included studies was performed using Quality Appraisal of Reliability Studies (QAREL). Only diagnostic accuracy studies meeting at least 50% of the designated inclusion criteria were utilized for analysis. Studies scoring less than 50% are presented descriptively and critically analyzed.

The level of evidence was classified as good, fair, and limited or poor based on the quality of evidence developed by the United States Preventive Services Task Force (USPSTF).

Data sources included relevant literature identified through searches of PubMed and EMBASE from 1966 to June 2012, and manual searches of the bibliographies of known primary and review articles.

**Results:** Overall, a total of 26 manuscripts were considered for diagnostic accuracy evaluation and 9 manuscripts for studies evaluating various factors influencing the diagnostic validity of facet joint interventions. Based on 9 studies meeting the inclusion criteria utilizing 75% to 100% pain relief as the criterion standard with controlled blocks, the evidence is good for diagnostic accuracy of cervical facet joint pain, with a prevalence of 36% to 60% with a false-positive rate of 27% to 63% with a single block. Based on 2 studies from the same group of authors, the evidence for 75% to 100% pain relief as the criterion standard with a single block is limited. The evidence is limited for a single diagnostic block with 50% to 74% pain relief as the criterion standard, whereas no studies were available assessing the accuracy of 50% to 74% pain relief as the criterion standard with controlled blocks.

**Limitations:** The limitations of this systematic review include a paucity of literature on outcomes, randomized, placebo-controlled trials and a lack of consensus on a gold standard.

**Conclusions:** Diagnostic cervical facet joint nerve blocks are safe, valid, and reliable. The strength of evidence for diagnostic facet joint nerve blocks is good with the utilization of controlled diagnostic blocks with at least 75% pain relief as the criterion standard; however, the evidence is limited for single blocks or dual blocks for relief of 50% to 74% and single blocks with at least 75% pain relief.

**Key words:** Chronic neck pain, cervical facet or zygapophysial joint pain, cervical medial branch blocks, controlled comparative local anesthetic blocks

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**C**hronic persistent neck pain has been reported to be present in almost 50% of individuals who report neck pain at some point in their lives (1-3). Furthermore, neck pain is common in the general adult population with a prevalence of 48% in women and 38% in men, with persistent complaints 22% of women and 16% of men. Studies of the prevalence of chronic neck pain (1-20) and its impact on general health (6,11,14) showed 14% of patients reporting Grade II to IV neck pain with high pain intensity with disability. Similar to low back pain, neck pain is also associated with significant economic, societal, and health impact, though not to the same extent as low back pain. In fact, neck pain is well recognized as a source of disability in the working population (15,19,20).

Cervical intervertebral discs, cervical facet joints, atlanto-axial and atlanto-occipital joints, ligaments, fascia, muscles, and nerve root dura have been shown to be capable of transmitting pain in the cervical spine with resulting symptoms of neck pain, upper extremity pain, and headache. However, very little is known about the causes of neck pain since the epidemiologic studies do not describe either the source or cause of the pain (2,17,21-23). Yin and Bogduk (23) in a study of 143 patients with chronic neck pain in a private practice pain clinic in the United States estimated the prevalence of discogenic pain in 16%, zygapophysial joint pain 55%, and lateral atlanto-axial joint pain 9%. In summary, diagnosis remained elusive in 32% of those patients who completed investigations. Based on controlled diagnostic blocks, cervical facet joints have been implicated as being responsible for pain in the neck, head, and upper extremities in 36% to 60% in heterogenous population (24-34).

Cervical facet or zygapophysial joints have been shown to be a source of pain in the neck and referred pain in the head and upper extremities (35-39). Cervical facet joints are well innervated by the medial branches of the dorsal rami (40-46) with free and encapsulated nerve endings with nociceptors and mechanoreceptors (41,42,46-62). Anatomical, biomechanical, and physiological basis has been described (63-70).

Dong et al (59) showed that neuronal stress activation is associated with painful facet injury, and that joint loading may directly mediate the behavior of the dorsal root ganglia (DRG) neurons in this class of injury. In vivo studies demonstrate that certain facet joint distractions initiate persistent firing of nociceptive afferents in the facet capsule (50), and induce persistent mechanical allodynia and spinal glial activation (53,54,59,60). Quinn

et al (58) showed that the frequency of neuronal firing increased in patients with neck pain compared to the non-painful and sham groups, as did the incidence and frequency of spontaneous and after discharge firing. They also showed that the proportion of cells in the deep laminae that responded as wide dynamic range neurons also increased in the painful group relative to non-painful or sham groups. They concluded that these findings suggest that excessive facet capsule stretch, while not producing visible tearing, can produce functional plasticity of dorsal horn neuronal activity. The increase in neuronal firing across a range of stimulus magnitude after injury provides the first direct evidence of neuronal modulation in the spinal cord following facet joint loading, and suggests that facet joint chronic pain following whiplash injury is driven, at least in part, by central sensitization.

Chua et al (57) also showed that there were differences in sensory processing between chronic cervical zygapophysial joint pain patients with and without cervicogenic headache. They showed that the main difference between patients with or without cervicogenic headache was the lateralization of pressure hyperalgesia to the painful side of the head of the headache patients, accompanied by cold as well as warm relative hyperesthesia on the painful side of the head and neck. They concluded that these results suggested that rostral neuraxial spread of central sensitization was probably linked to the trigeminal spinal nucleus. Dong et al (59) also showed spinal glutamatergic system potentiation of persistent behavioral hypersensitivity that is produced following dynamic whiplash-like joint loading. Even though there is continuing discussion on the role of facet joint degeneration in chronic neck pain as a rationale for the treatment of back pain, the morphology of lumbar facet joint degeneration has been described by means of microscopic inspection, histology, and clinical imaging techniques such as conventional tomography, computed tomography (CT), magnetic resonance imaging (MRI), or plain radiography (61). In these studies, the pathological changes attributed to facet joint degeneration were articular cartilage thinning, sclerosis of the subchondral bone, osteophyte formation, or hypertrophy. Kettler et al (61) after evaluating the morphological changes of cervical facet joints in the elderly concluded that the prevalence of cervical facet joint degeneration is probably very high in individuals aged 50 years and more, with a tendency to increase in severity with age. All levels of the middle and lower cervical spines

were affected to almost the same degree, whereas in the lumbar spine, an increase in degeneration towards the lower levels was reported. In most cases, the cartilage in the cervical spine was evenly degenerated all over the joint surface while in the lumbar spine, certain regions were reported to be affected predominantly. In this study, only specimens of facet joints from 59 to 92 aged persons were evaluated. In addition, degenerative and traumatic changes in the lower cervical spine facet joints have been reported (62). The evaluation was performed only in the lower cervical spine facet joints from C4 through C7. These findings supported the existing knowledge that males are more commonly affected by degenerative changes than females and that these changes commonly occur at a young age. Histomorphometry also confirmed the presence of synovial fluids in all of the facet joints. Furthermore, following spinal trauma, pathological lesions may be produced in the facet joints and/or accentuate already existing pathology. Hypertrophic change of facet joints in the cervical spine also have been described (71). In another study (72), it was illustrated that stretching the facet joint capsule beyond physiological range could result in an altered axonal morphology that may be related to secondary or delayed axotomy changes similar to those seen in central nervous system injuries where axons are subjected to stretching and shearing. It was concluded that these changes may contribute to neuropathic pain and are potentially related to neck pain after whiplash events. Morishita et al (71) examined the image and clinical characteristics of patients with cervical facet hypertrophy and the significance of such characteristics and concluded that hypertrophic change of facet joint occurred at the mid-level of the cervical spine, usually unilaterally, was more frequent in males, and was associated with neck pain. Whiplash may also cause increased laxity of the cervical capsular ligament (73). One interpretation is that capsular ligament injuries, in the form of increased laxity, may be one component perpetuating chronic pain and clinical instability in whiplash patients. In fact, Bogduk (74) in describing biological features of whiplash injury showed that a spectrum of injuries can occur in the zygapophysial joints in motor vehicle accidents based on results of postmortem studies. He concluded that the fact that multiple lines of evidence, using independent techniques, consistently implicate the cervical zygapophysial joints as a site of injury and source of pain, strongly suggesting that injury to these joints is a common basis for chronic neck pain after whiplash.

Curatolo et al (75) also discussed the role of tissue damage in whiplash-associated disorders. Their results demonstrated that numerous investigations conducted in animals, cadavers, healthy volunteers, and patients have documented lesions of various tissues. Furthermore, most lesions are undetected by imaging techniques. However, for zygapophysial (facet) joints, lesions have been predicted by bioengineering studies and validated through animal studies; for zygapophysial joint pain, a valid diagnostic test and a proven treatment are available. The influence of lower cervical joint pain on a range of motion also has been described (76). Hall et al (76) showed that the average range of unilateral rotation to the limited side during flexion-rotation test (FRT) was significantly reduced in the patients with lower cervical facet joint pain. Finally, Javanshir et al (77) investigated the differences in pressure and thermal pain hypersensitivity between patients with acute and chronic neck pain and healthy subjects. They found widespread decreased pressure pain thresholds in patients with chronic but not acute, mechanical neck pain as compared with controls. Furthermore, as compared with patients with acute neck pain and controls, patients with chronic neck pain also showed cold pain hypersensitivity. They concluded that the results supported the existence of different sensitization mechanisms between patients with acute and chronic mechanical insidious neck pain. However, neck muscle strength and its relationship to neck pain have not been widely studied.

Even though a preponderance of evidence supports the existence of cervical facet joint pain and its prevalence utilizing controlled diagnostic blocks, a significant proportion of patients suspected of cervical facet joint pain present with false-positive results of 27% to 63% (24-29,34,78). Thus, to maintain the accuracy of diagnosis, facet joint blocks must be performed under controlled conditions, either with a placebo or with controlled comparative local anesthetic blocks utilizing 2 local anesthetics of different durations of action. Falco et al (34) reported that the outcome measurement needs to be appropriate providing significant pain relief ( $\geq 80\%$ ) and that the outcome must be the ability to perform previously painful movements with sustained pain relief. While diagnostic blocks may provide approximately 3 weeks of relief with the first block and approximately 6 weeks of relief with the second block (79,80), Chua et al (81) showed that despite the return of neck pain after the local anesthetic agents wore off, patients admitted to generalized

electrical hypoalgesia and significantly reduced conditioned pain modulation responses. They concluded that based on preliminary evidence, the perturbations to the sensory processing system from effective diagnostic blocks positively affect the tonic inhibitory system. They also stated, however, that conditioned pain modulation needs to be interpreted in the context of altered pain thresholds, and that any shift in the nociceptive balance between facilitatory and inhibitory control after therapeutic interventions has to be further investigated.

The latest systematic review (34), published in 2009, showed strong evidence for the diagnostic accuracy of cervical facet joint blocks. In addition, Rubinstein and van Tulder (82) in a best-evidence review of diagnostic procedures for neck and low back pain concluded that there was strong evidence for the diagnostic accuracy of facet joint blocks in the diagnosis of neck pain. Significant debate surrounds the various treatments utilized in the management of chronic neck pain arising from cervical facet joints (2,34,82-96), even though the diagnosis has been well established.

The diagnosis of facet joints may not be made based on a radiologic evaluation or clinical assessment with certainty (97-99). There is little information on the validity or utility of a self-reported history in evaluating neck pain disorders (97-101). While clinical routine physical examination is more effective in ruling out cervical radiculopathy than confirming its presence, it's usefulness in non-radicular disorders or facet joint pain is debatable. Local tenderness is not diagnostic of zygapophysial joint pain in the cervical spine (102). A manual examination of the cervical spine is not a valid means of diagnosing cervical zygapophysial joint pain (100). There is however, some evidence that some features of inspection, range of motion, strength, palpation, and provocation tests can be useful. Range of motion has been described to be moderately reliable, as it does not seem to matter whether it is assessed by the clinician (assessing active or passive range of motion with or without a device) or self-described by the patient (97,100-110). There is also some evidence that chronic whiplash-associated disorder patients and subjects with neck pain and myalgia have less mobility in the cervical spine compared with controls (111). Patients with chronic neck pain also may have slightly lower neck muscle strength compared with controls (107). Even then, a role for physiotherapists has been suggested in the screening of patients suitable for diagnostic cervical facet joint blocks (112). Schneider et al (112) showed that utilizing clinical prediction guides

may allow practitioners to use the results of a patient's history, self-report measures, and physical examination toward optimal diagnostic and therapeutic decisions; namely, selecting the patient for cervical diagnostic facet joint blocks.

There is no evidence that common degenerative changes on a cervical MRI are strongly correlated with neck pain symptoms (97). The evidence illustrates that common degenerative changes are highly prevalent in asymptomatic subjects and are also prevalent with increasing age (113-130). Moreover, there is no evidence that common degenerative changes on cervical MRI are associated with pain in patients with suspected cervicogenic headache (97,130). Multiple evaluations have been shown to be non-diagnostic to facet joint pain (124-129). The utilization of an MRI to evaluate patients with acute unilateral neck pain and restricted motion (125) showed no synovial effusion or inflammation around the joints of the cervical spine.

Single photon emission computerized tomography scan (SPECT) was shown to have increased uptake into the facet joints in only 43% of patients (131). While there is ample literature addressing low back pain, there is no significant literature for the cervical spine for the diagnosis of facet joint pain by SPECT (132-137).

Self assessment questionnaires; however, may have utility in routine clinical practice and research by categorizing patients' clinical presentation, subjective functional impact of neck pain and force over time (97). However, there is no evidence that a self-assessment questionnaire alone can accurately diagnose a structural cause of illness in patients with neck pain. There is evidence that generic questionnaires may be more useful than neck specific questionnaires for comparing individuals with neck pain with other disease groups (105,108,109,138-141). In one study, however, it was shown that in patients with neck pain the use of a self-assessment questionnaire to monitor health care utilization showed poor recollection of health care utilization, rendering it unreliable as a source (100).

Thus, multiple evaluations may be the basis for a suspicion of, but not diagnosis of cervical facet joint pain. Even though debate continues on the diagnostic and therapeutic management of chronic pain in general and neck pain in particular, cervical facet joint interventions, along with multiple other interventions used in managing chronic neck pain, are increasing (34,83-96,142-160).

The diagnostic and therapeutic literature was reviewed in 2009 (34). However, due to evolving concepts

and increasing health care utilization, health care costs, resulting in a crisis in the United States, it is essential to update the evidence (161,162). Thus, this systematic review was undertaken to evaluate and update the accuracy of diagnostic cervical facet joint interventions in the diagnosis of cervical facet joint pain (34).

## 1.0 METHODS

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The methodology utilized in this systematic review followed the review process derived from evidence-based systematic reviews and meta-analysis of diagnostic accuracy studies (34,82,163-184).

### 1.1 Criteria for Considering Studies for This Review

#### 1.1.1 Types of Studies

Diagnostic accuracy of facet joint blocks evaluating cervical facet joint pain.

#### 1.1.2 Types of Participants

Participants of interest were adults aged at least 18 years with chronic neck and upper extremity pain of at least 3 months duration.

Participants must have failed previous pharmacotherapy, exercise therapy, etc., prior to starting diagnostic interventional pain management techniques.

#### 1.1.3 Types of Interventions

The interventions were diagnostic cervical facet joint blocks appropriately performed with proper technique under fluoroscopic or CT guidance.

#### 1.1.4 Types of Outcome Measures

- ◆ The primary outcome parameter was pain relief concordant with the type of controlled diagnostic blocks performed.
- ◆ The secondary outcome measure was the ability to perform previously painful movements without significant pain or complications.
- ◆ At least 2 of the review authors independently, in an unblinded standardized manner, assessed the outcomes measures. Any disagreements between reviewers were resolved by a third author and consensus.

### 1.2 Literature Search

Searches were performed from the following sources without language restrictions:

1. PubMed from 1966

- www.ncbi.nlm.nih.gov/sites/entrez?db=pubmed
2. EMBASE from 1980  
www.embase.com/
3. Cochrane Library  
www.thecochranelibrary.com/view/0/index.html
4. U.S. National Guideline Clearinghouse (NGC)  
www.guideline.gov/
5. Previous systematic reviews and cross references
6. Clinical Trials  
clinicaltrials.gov/

The search period was from 1966 through June 2012.

### 1.3 Search Strategy

The search strategy emphasized chronic neck pain of facet joint origin with a focus on all types of diagnostic interventions. Search terminology included cervical facet joint, cervical facet joint pain, cervical diagnostic facet joint blocks, cervical facet joint intraarticular injections, and medial branch blocks.

This systematic review focused only on diagnostic studies, including invasive techniques and reports of complications. Only cervical facet joint injections performed under fluoroscopy or CT imaging techniques were evaluated. Interventional techniques performed blindly or using other identification modalities were excluded. All studies describing appropriate outcome evaluations with proper statistical evaluations were reviewed. Reports without appropriate diagnosis, nonsystematic reviews, book chapters, and case reports were excluded.

At least 2 of the review authors independently, in an unblinded standardized manner, performed each search. All searches were combined to obtain a unified search strategy. Any disagreements between reviewers were resolved by a third author and consensus.

### 1.4 Data Collection and Analysis

The quality of each individual article used in this assessment was based on the Quality Appraisal of Reliability (QAREL) checklist (Table 1) (166). This checklist has been validated and utilized in multiple systematic reviews (167). Each study in the final sample of eligible manuscripts was assessed using a 12-item appraisal checklist designed to assess the quality and applicability of studies. The face validity of these checklists was established by consultation with methodology experts (166) and comparison with quality appraisal checklists used in other systematic reviews examining diagnostic

reliability (185-190). This checklist was also developed in accordance to the Standards for Reporting Studies of Diagnostic Accuracy (STARD) (170), and the Quality Assessment of Diagnostic Accuracy Studies (QUADAS) (170,171) appraisal tool. Studies were not given an overall numeric quality score; instead, each item was considered separately and graded as "yes," "no," "unclear," or "not applicable."

**1.4.1 Selection of Studies**

- ◆ In an unblinded standardized manner, 2 review authors screened the abstracts of all identified studies against the inclusion criteria.
- ◆ All articles with possible relevance were then retrieved in full text for comprehensive assessment of internal validity, quality, and adherence to inclusion criteria.

**1.4.2 Inclusion and Exclusion Criteria**

**Inclusion Criteria**

Prospective and retrospective studies published on the diagnosis of cervical facet joint pain in patients with chronic pain of greater than 3 months duration were included for review. Only the studies utilizing controlled diagnostic

blocks under fluoroscopy were included. The criterion standard for diagnosis of cervical facet joint pain was at least 50% pain relief for the duration of local anesthetic and ability to perform previously painful movements.

**Exclusion Criteria**

All non-clinical studies were excluded. Ultrasound guided injections, case reports, book chapters, non-evidence-based guidelines, letters, and expert opinions were excluded.

**1.4.3 Clinical Relevance**

The clinical relevance of the included studies was evaluated according to 5 questions recommended by the Cochrane Back Review Group (Table 2) (191,192). Each question was scored as positive (+) if the clinical relevance item was met, negative (-) if the item was not met, and unclear (?) if data were not available to answer the question.

**1.4.4 Methodological Quality or Validity Assessment**

Each study was evaluated by at least 2 authors for stated criteria, with any disagreements discussed with a third reviewer. Authors with a perceived conflict of

Table 1. *Quality Appraisal of Diagnostic Reliability (QAREL) checklist.*

Item	Yes	No	Unclear	N/A
1. Was the test evaluated in a spectrum of subjects representative of patients who would normally receive the test in clinical practice?				
2. Was the test performed by examiners representative of those who would normally perform the test in practice?				
3. Were raters blinded to the reference standard for the target disorder being evaluated?				
4. Were raters blinded to the findings of other raters during the study?				
5. Were raters blinded to their own prior outcomes of the test under evaluation?				
6. Were raters blinded to clinical information that may have influenced the test outcome?				
7. Were raters blinded to additional cues, not intended to form part of the diagnostic test procedure?				
8. Was the order in which raters examined subjects varied?				
9. Were appropriate statistical measures of agreement used?				
10. Was the application and interpretation of the test appropriate?				
11. Was the time interval between measurements suitable in relation to the stability of the variable being measured?				
12. If there were dropouts from the study, was this less than 20% of the sample.				
<b>TOTAL</b>				

Lucas N, Macaskill P, Irwig L, Moran R, Bogduk N. Reliability of physical examination for diagnosis of myofascial trigger points. *Clin J Pain* 2008; 25:80-89 (166).

interest for any manuscript were recused from reviewing the manuscript.

Only diagnostic accuracy studies meeting at least 50% of applicable inclusion criteria were included for analysis. Studies scoring less than 50% are reported descriptively with critical analysis.

**1.4.5 Data Extraction and Management**

Two review authors independently, in an unblinded standardized manner, extracted the data from the included studies. Disagreements were resolved by discussion between the 2 reviewers; if no consensus could be reached, a third author was called in to break the impasse.

**1.4.6 Assessment of Heterogeneity**

Analysis of the evidence was based on diagnostic criteria as follows: 1) blocks in which the reference standard for diagnosis was between 50% to 74% pain relief with a single block; 2) blocks in which the reference standard for diagnosis was between 50% to 74% pain relief with either placebo controlled or comparative controlled diagnostic blocks; 3) blocks in which the reference standard for diagnosis was between 75% to 100% pain relief with a single block; and 4) blocks in which the reference standard for diagnosis was between 75% to 100% pain relief with either placebo controlled or comparative controlled diagnostic blocks, to reduce clinical heterogeneity.

**1.4.7 Measurement of Treatment Effect in Data Synthesis (Meta-Analysis)**

Data was separately summarized using meta-analysis when at least 5 studies per type of diagnostic criteria were available that met the inclusion criteria (e.g., single block, double blocks, and 50% to 80% relief).

The minimum acceptable relief was considered to be 50%; however, data were analyzed for  $\geq 75\%$  and 50% to 74% relief as the cutoff threshold for a positive block during the performance of previously painful movements. Four separate diagnostic categories were evaluated (i.e., 50% to 74% relief as the cutoff threshold with single and dual blocks; and 75% to 100% relief as the cutoff threshold with single or dual blocks). For dual blocks, there had to have been a concordant response with short-acting and long-acting local anesthetics, or placebo.

**1.4.8 Integration of Heterogeneity**

A meta-analysis was performed only if there were at least 5 homogeneous studies meeting the inclusion criteria for each variable.

Statistical heterogeneity was explored using univariate meta-regression (193).

**1.5 Summary Measures**

Summary measures included 50% to 74% or 75% to 100% pain relief with the capability of performing previously painful movements concordant with the duration of local anesthetic.

**1.6 Analysis of Evidence**

The analysis of the evidence was performed based on United States Preventive Services Task Force (USPSTF) criteria (194) as illustrated in Table 3, which has been utilized by multiple authors (164,165,179,194-203).

The analysis was conducted using 3 levels of evidence ranging from good, fair, and limited or poor (164,165,179,194-203).

At least 2 of the review authors independently, in an unblinded standardized manner, analyzed the evi-

Table 2. *Clinical relevance questions.*

	P (+)	N (-)	U (unclear)
A) Are the patients described in detail so that one can decide whether they are comparable to those who are treated practice?			
B) Are the interventions and treatment settings described in sufficient detail to apply its use in clinical practice?			
C) Were clinically relevant outcomes measured and reported?			
D) Is the size of the effect clinically meaningful?			
E) Do the likely treatment benefits outweigh the potential harms?			

Scoring adapted and modified from Staal JB, et al. Injection therapy for subacute and chronic low-back pain. *Cochrane Database Syst Rev* 2008; 3:CD001824 (192).

Table 3. Method for grading the overall strength of the evidence for an intervention.

Grade	Definition
Good	Evidence includes consistent results from well-designed, well-conducted studies in representative populations that directly assess effects on health outcomes (at least 2 consistent, higher-quality RCTs or studies of diagnostic test accuracy).
Fair	Evidence is sufficient to determine effects on health outcomes, but the strength of the evidence is limited by the number, quality, size, or consistency of included studies; generalizability to routine practice; or indirect nature of the evidence on health outcomes (at least one higher-quality trial or study of diagnostic test accuracy of sufficient sample size; 2 or more higher-quality trials or studies of diagnostic test accuracy with some inconsistency; at least 2 consistent, lower-quality trials or studies of diagnostic test accuracy, or multiple consistent observational studies with no significant methodological flaws).
Limited or Poor	Evidence is insufficient to assess effects on health outcomes because of limited number or power of studies, large and unexplained inconsistency between higher-quality trials, important flaws in trial design or conduct, gaps in the chain of evidence, or lack of information on important health outcomes.

Adapted and modified from methods developed by U.S. Preventive Services Task Force (179,194-203).

dence. Any disagreements between reviewers were resolved by a third author and consensus. If there were any conflicts of interest (e.g., authorship), those reviewers were recused from assessment and analysis.

### 1.7 Outcome of the Studies

Outcomes included the prevalence of cervical facet joint pain and false-positive rate. Based on the above parameters, the reliability of the data derived from each study was assessed.

## 2.0 RESULTS

Figure 1 shows the flow diagram of study selection. There were 26 considered for inclusion (23-33,35-39,43,78,159,204-210). Among these, 5 studies evaluated pain patterns (35-39), and were therefore not included in the accuracy or prevalence evaluation. Diagnostic accuracy or false-positive rate was evaluated in 12 studies (23-25,27,29,30,32,33,78,159,204,206). An additional 8 studies evaluated the influence of various factors on the diagnosis and prevalence of facet joint pain (26,28,31,205,206,208-210). There was one study that failed to meet the inclusion criteria, in which Barnsley and Bogduk (43) assessed the specificity of medial branch blocks without an evaluation of the accuracy of false-positive rates.

### 2.1 Diagnostic Accuracy Studies

Table 4 illustrates characteristics of the diagnostic accuracy studies considered for inclusion (23-25,27,29,30,32,33,78,159,204,206). Of these, one study (206) utilized 50% to 74% relief as the criterion standard or cutoff threshold for a positive block, whereas 2 studies utilized 75% to 100% pain relief as the criterion standard with a single block (159,204). There were

no studies evaluating with controlled diagnostic blocks with 50% relief as the criterion standard. There were 9 studies utilizing controlled diagnostic blocks with a > 75% cutoff threshold (23-25,27,29,30,32,33,78).

### 2.2 Factors Influencing Diagnosis

Table 5 illustrates the study characteristics of published reports of cervical facet joint blocks evaluating the influence of various factors on diagnostic accuracy (26,28,31,205,206,208-210).

### 2.3 Clinical Relevance

Of the 19 studies assessed for clinical relevance (23-33,78,159,204-206,208-210), 18 of the studies met criteria with score of 3 of 5 or greater (23-33,78,159,204,206,208-210). Table 6 illustrates assessment of clinical relevance.

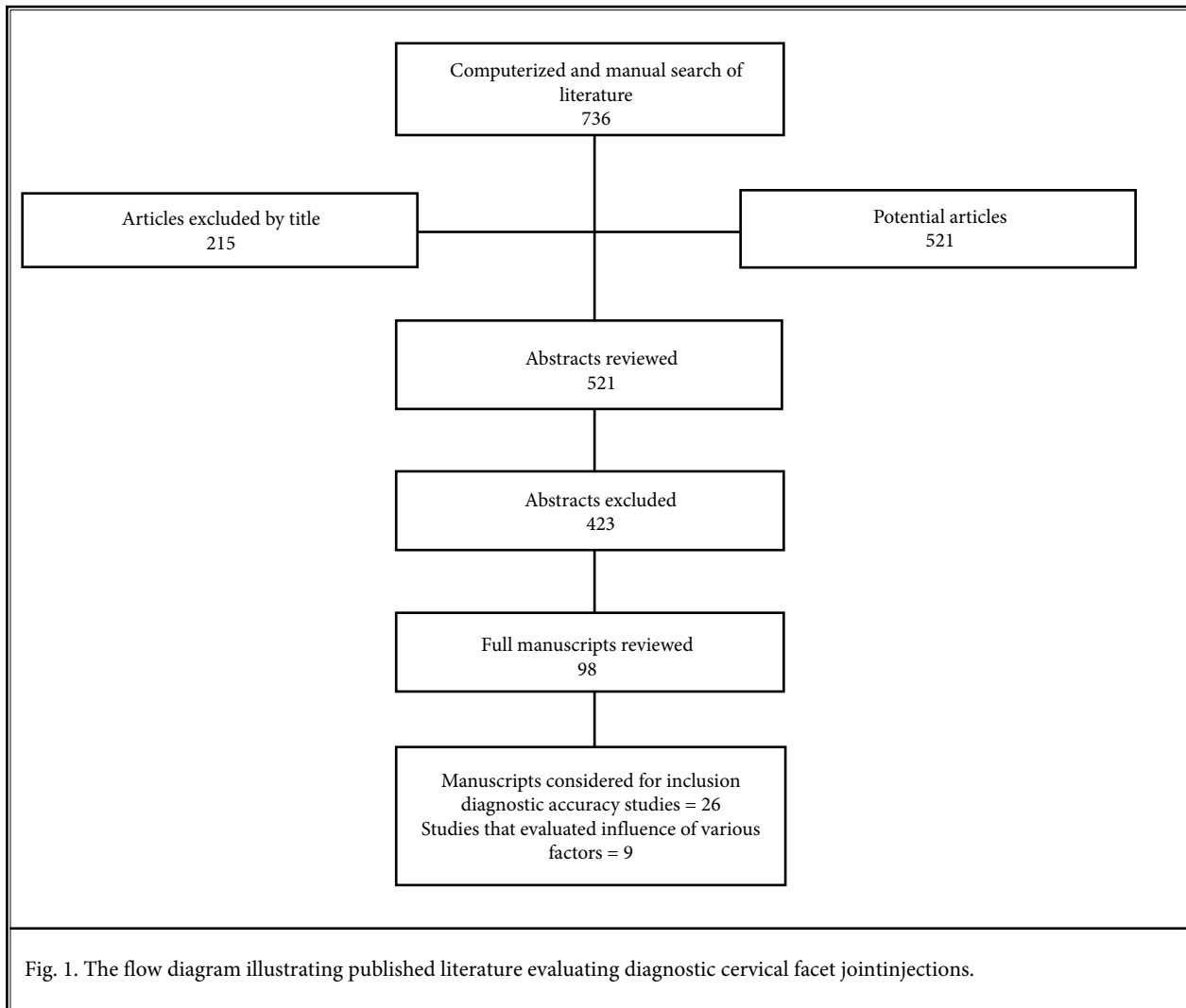
### 2.4 Methodological Quality Assessment

A methodological quality assessment of diagnostic accuracy studies meeting inclusion criteria was carried out utilizing QAREL criteria as shown in Table 7. Studies achieving 50% or higher scores were included. Scores of 67% or higher were considered to be high quality, 50% were considered to be moderate quality, and studies scoring less than 50% were considered to be of poor quality and excluded.

### 2.5 Meta-Analysis of Diagnostic Accuracy Studies

There were 3 randomized trials (33,78,206) and 2 placebo-controlled studies of diagnostic accuracy (33,78). There was one study in the single block group using 50% to 74% relief as the cutoff threshold (206). Two studies met inclusion that utilized a single block





with a cutoff threshold > 75% pain relief (159,204). There were no studies with a cutoff between 50% and 74% pain relief that employed controlled diagnostic blocks as the criterion standard.

There were 9 studies (23-25,27,29,30,32,33,78) using controlled diagnostic blocks with a criterion standard ranging between 75% and 100% relief. In this evaluation, 4 studies utilized  $\geq 90\%$  pain relief (30,32,33,78), whereas 5 studies utilized 75% or greater relief as criterion standard (23-25,27,29). Inclusion criteria were different. Thus, there was homogeneity only among the 4 studies (24,25,27,29). Consequently, there was no meta-analysis performed.

## 2.6 Analysis of Evidence

The evidence was synthesized based on the relief criteria when cervical facet joint injections were performed. Table 8 illustrates the results of diagnostic studies.

### 2.6.1 Single Block with 50% to 74% Pain Relief

There was only one study evaluating the role of cervical facet joint nerve blocks with  $\geq 50\%$  relief with a single block as the criterion standard (206). This was not designed to be a prevalence study; however, it showed a prevalence of 25% in patients with 0.5 mL of bupivacaine administered and 55% in patients administered with 0.25 mL of bupivacaine.

Table 4. Study characteristics of published reports of cervical facet joint blocks of diagnostic accuracy.

STUDY/METHODS	PARTICIPANTS	OBJECTIVE(S)	INTERVENTION(S)	RESULT(S)	CONCLUSION
<b>50% - 74% WITH SINGLE BLOCK</b>					
Cohen et al, 2010 (206) Randomized	24 patients with chronic neck pain were allocated to receive cervical medial branch blocks. Patients were selected with predominance of axial cervical pain for more than 3 months, with failure to respond to conservative therapy, and asymmetry in laterality.	To determine whether reducing the volume for cervical medial branch blocks can enhance the specificity. This study was conducted in an academic setting.	24 patients were randomly allocated into 2 groups with 0.25 mL or 0.5 mL of 0.375% bupivacaine, either in the lateral position or prone position.	Prevalence = 55% with low volume and 25% with high volume.	Small study with perplexing results showing volume spread and the specificity of the blocks had no relevance to positive response.
<b>75% - 100% WITH SINGLE BLOCK</b>					
April & Bogduk, 1991 (159) Prospective	The records were reviewed of 318 patients with chronic neck pain of at least 6 months without myelopathy from January 1989 to April 1990 in a radiology practice in New Orleans.	The authors wanted to test a null hypothesis to the effect that cervical zygapophysial joint pain was uncommon.	Intraarticular lidocaine injection after contrast injection with provocation with assessment of provocation and pain relief.	Approximate prevalence = 63%. A 25% positive rate with the possibility that an additional 38% suffered with zygapophysial joint pain.	The study was performed in a radiology setting and only with patients who were involved in a motor vehicle injury. Only a single block was performed.
Bogduk & April, 1993 (204) Prospective	56 patients underwent both provocation discography and cervical zygapophysial joint blocks. A positive response was considered as complete pain relief for the duration of action of the local anesthetic used.	To determine the prevalence of disc pain and zygapophysial joint pain occurring simultaneously in the same segment of the neck.	Cervical discography, along with cervical medial branch blocks utilizing 0.5 mL of 0.5% bupivacaine with complete relief lasting the duration of action of the local anesthetic used.	A 41% positive rate of disc and zygapophysial joint. Zygapophysial joints alone positive in 23%. Overall, zygapophysial joint pain may be present in 64% of patients.	All the patients included suffered some type of injury. Furthermore, a great proportion (41%) of patients had both discogenic and zygapophysial joint pain. Only a single block was performed even though 100% relief was utilized as the criterion standard.
<b>75% - 100% WITH CONTROLLED BLOCKS</b>					
Yin and Bogduk, 2008 (23) Retrospective	143 patients with chronic neck pain of various origins of at least 3 months duration were included. A total of 84 patients underwent cervical medial branch blocks.	To provide a first approximation of the possible sources and causes of neck pain in a private practice in order to avoid the possible selection bias that can affect studies conducted in academic units. The study was conducted in a private practice setting rather than an academic setting.	Cervical controlled, comparative local anesthetic medial branch blocks with either 4% lignocaine or 0.75% bupivacaine.	Prevalence = 55% Positive responses were determined with duration of relief based on the local anesthetic with concordant response (i.e., patients were required to have long-lasting relief when 0.75% bupivacaine was administered and short-lasting relief when 4% lignocaine was administered).	In this evaluation a large proportion of patients (36%) did not pursue investigations, which diluted the crude prevalence of various conditions. A diagnosis remained elusive in 32% of those patients who completed investigations.

Table 4 (cont.). Study characteristics of cervical facet joint blocks of diagnostic accuracy.

STUDY/METHODS	PARTICIPANTS	OBJECTIVE(S)	INTERVENTION(S)	RESULT(S)	CONCLUSION
Manchukonda et al, 2007 (24) Retrospective	A total of 251 consecutive patients receiving controlled, comparative local anesthetic blocks with chronic neck pain were included. Patients had pain for at least 6 months, which was nonspecific without a radicular component.	To determine the prevalence of facet joint pain by spinal region in patients with chronic spinal pain presenting to an interventional pain management practice for diagnosis and treatment. The study was conducted in a private practice setting rather than an academic setting.	Controlled diagnostic medial branch blocks using 1% lidocaine or 0.25% bupivacaine, 0.5 mL per medial branch, on 2 separate occasions, usually 3 to 4 weeks apart were performed. A positive response was considered at least an 80% reduction of pain with the ability to perform previously painful movements. There were no withdrawals.	Prevalence = 39% False-positive rate = 45%	This is the second largest study following the previous one (28) with inclusion of the heterogeneous population and 251 patients with neck pain yielding a moderate prevalence of 39% with a false-positive rate of 45%.
Manchikanti et al, 2004 (25) Prospective	The study evaluated 255 consecutive patients presenting with chronic neck pain. Patients suffered with chronic neck pain without disc-related pain with radicular symptoms.	To evaluate the prevalence of facet joint pain by spinal region in patients with chronic spinal pain presenting to an interventional pain management practice for diagnosis and treatment. The study was conducted in a private practice setting rather than an academic setting.	Controlled diagnostic medial branch blocks using 1% lidocaine or 0.25% bupivacaine, 0.5 mL per medial branch, on 2 separate occasions, usually 3 to 4 weeks apart were performed. A positive response was considered at least an 80% reduction of pain with the ability to perform previously painful movements. There were no withdrawals.	Prevalence = 55% False-positive rate = 63%	This is the largest study until 2004 with patients with neck pain, yielding a 55% prevalence rate in the cervical spine, with a false-positive rate of 63%.
Manchikanti et al, 2002 (27) Prospective	120 consecutive patients presenting with complaints of chronic low back pain and neck pain, in a non-university setting, in one private comprehensive interventional pain management practice were evaluated.	This study was undertaken to evaluate the prevalence and correlation of facet joint pain in patients with chronic low back pain and neck pain. The study was conducted in a private practice setting rather than an academic setting.	Controlled diagnostic medial branch blocks using 1% lidocaine or 0.25% bupivacaine, 0.5 mL per medial branch, on 2 separate occasions, usually 3 to 4 weeks apart were performed. A positive response was considered at least an 80% reduction of pain with the ability to perform previously painful movements. There were no withdrawals.	Prevalence = 67% False-positive rate = 63%	Prevalence may have been higher due to the nature of the selection criteria. Authors utilized controlled, comparative local anesthetic blocks yielding high false-positive rates.
Manchikanti et al, 2002 (29) Prospective	106 consecutive patients with chronic neck pain of various origins were included. Patients must have had pain for at least 6 months and also have failed conservative management without any evidence of radiculitis or disc herniation.	To determine the prevalence of cervical facet joint pain using controlled diagnostic blocks in a sample of patients with chronic neck pain presenting to an interventional pain management practice in a private practice setting in the United States. The study was conducted in a private practice setting rather than an academic setting.	Controlled diagnostic medial branch blocks using 1% lidocaine or 0.25% bupivacaine, 0.5 mL per medial branch, on 2 separate occasions. A positive response was considered at least an 75% reduction of pain with the ability to perform previously painful movements. There were no withdrawals.	Prevalence = 60% False-positive rate = 40%	This is the only study outside the group of Australians evaluating the prevalence of cervical facet joint pain in chronic neck pain of heterogeneous origin yielding a prevalence of 60% with controlled diagnostic blocks and a false-positive rate of 40%.

Table 4 (cont.). Study characteristics of cervical facet joint blocks of diagnostic accuracy.

STUDY/METHODS	PARTICIPANTS	OBJECTIVE(S)	INTERVENTION(S)	RESULT(S)	CONCLUSION
Speldewinde et al, 2001 (30) Retrospective	97 patients with chronic neck pain were evaluated by 3 independent rehabilitation physicians undergoing diagnostic cervical medial branch blocks from 1994 to 1997.	This study was conducted to determine the prevalence of facet joint pain in a private practice setting and compare it to research centers.	Controlled, comparative local anesthetic blocks, 2% lignocaine or 0.5% bupivacaine, with 100% pain relief as the criterion standard.	Prevalence = 36%	The authors utilized 100% pain relief as the criterion standard with controlled diagnostic blocks utilizing strict selection criteria in a heterogeneous population in a private practice setting in a retrospective evaluation.
Barnsley et al, 1995 (32) Prospective	50 consecutive patients referred to the cervical spine research unit, a tertiary referral unit, in Australia were evaluated. The criteria for inclusion were neck pain of more than 3 months duration following and attributed to a motor vehicle accident, previous assessment.	To assess the prevalence of chronic cervical zygapophysial joint pain after whiplash with controlled diagnostic blocks in a research setting.	Patients were classified as having a painful cervical zygapophysial joint only if they achieved definite or complete relief of pain with both anesthetics and a longer duration of pain relief after the use of bupivacaine.	Prevalence = 54%	The study was performed in a highly specialized academic research unit in Australia in patients after whiplash injury.
Lord et al, 1996 (33) Randomized, double blind	68 consecutive patients referred for chronic neck pain after whiplash were studied in a cervical spine research unit in Australia. The criteria for inclusion were 3 months duration of neck pain after a motor vehicle accident and evaluation by a consultant specialist before referral, and over 18 years of age.	The study was undertaken to determine the prevalence of cervical zygapophysial joint pain using a stringent, double-blind protocol that incorporated a placebo control, in a sample of patients with chronic neck pain after whiplash injury. The major interest of this study is the placebo control and validation of the cervical medial branch blocks.	In this placebo controlled study, diagnostic blocks were performed utilizing 2% lidocaine or 0.5% bupivacaine for the first block. If a patient obtained relief from the first block, on the second occasion, they were allocated randomly to receive either normal saline or the local anesthetic but they did not receive for their first block. On the third occasion, they received the remaining agent. 100% pain relief was the criterion standard. 11 patients withdrew from the study	Prevalence = 60%	The study was performed in a highly specialized academic research unit in Australia in patients after whiplash injury.
Barnsley et al, 1993 (78) Randomized, double blind	The study evaluated 55 consecutive patients with neck pain of greater than 3 months attributed to a motor vehicle accident.	To determine the false-positive rate of anesthetic blocks of the medial branches of the cervical dorsal rami in the diagnosis of cervical zygapophysial joint pain in a highly specialized cervical spine research unit in Australia.	Each patient was randomly assigned to receive either 2% lignocaine or 0.5% bupivacaine as the initial local anesthetic. The patient and the evaluator were blinded to the type of local anesthetic.	False-positive rate = 27%	A well-performed study in a highly research oriented center in patients after whiplash.

Table 5. Study characteristics of published reports of cervical facet joint blocks evaluating various factors influencing diagnostic accuracy.

Study/Methods	Participants	Objective(S)	Intervention(S)	Result(S)	Conclusion
Manchikanti et al, 2008 (26) Retrospective	This study evaluated 424 patients with spinal pain, consecutive patients in a retrospective evaluation, with 251 presenting with chronic, persistent cervical pain, in a non-university, private practice setting in the United States. All patients suffered pain of longer than 6 months and also had failed conservative management. Disc herniation and radiculitis were excluded.	To assess the age-related prevalence and false-positive rates of facet joint involvement in chronic spinal pain using controlled, comparative local anesthetic blocks.	Age groups and controlled diagnostic medial branch blocks using 1% lidocaine or 0.25% bupivacaine, 0.5 mL per medial branch, on 2 separate occasions, usually 3 to 4 weeks apart were performed. A positive response was considered at least an 80% reduction of pain with the ability to perform previously painful movements.	False-positive rate ranged from 39% to 56% based on the age groups with a mean false-positive rate of 45%. The prevalence ranged from 33% to 42% from Group I to Group VI with the lowest prevalence in Group VI, constituting of those over the age of 70, and the highest prevalence of 42% in Group I, constituting 18 to 30 year age group.	The first age-related prevalence study with controlled, comparative local anesthetic blocks in a heterogeneous population in a private practice setting.
Manchikanti et al, 2008 (28) Retrospective	251 consecutive patients with persistent neck pain requiring diagnostic facet joint nerve blocks were evaluated. There were 45 patients post surgery and 206 patients without surgery with chronic persistent neck pain of at least 3 months duration after failure of conservative management.	This retrospective evaluation was conducted to assess and compare the prevalence of chronic post surgical facet joint cervical spinal pain to non-surgical, chronic cervical facet joint pain. This study was conducted in a practical setting.	Patients with or without cervical surgery were evaluated with controlled diagnostic medial branch blocks using 1% lidocaine or 0.25% bupivacaine, 0.5 mL per medial branch, on 2 separate occasions, usually 3 to 4 weeks apart. A positive response was considered at least an 80% reduction of pain with the ability to perform previously painful movements.	Without surgery: Prevalence = 39% False-positive rate = 43%  Posturgery: Prevalence = 36% False-positive rate = 50%	This is the only study evaluating the differences in prevalence following surgical intervention. Even though this is a retrospective evaluation, it utilized controlled, comparative local anesthetic blocks and in a practical setting.
Manchikanti et al, 2008 (31) Retrospective	301 patients undergoing controlled, comparative local anesthetic blocks for diagnosis of cervical facet joint pain were included in this study in a retrospective evaluation. Patients suffered with chronic disabling neck pain of at least 6 months duration and have failed to respond to conservative managements, with or without associated psychological diagnosis.	To study the influence of psychopathology (depression, generalized anxiety disorder, and somatization, individually or in combination of multiple psychopathologic conditions) on the ability of controlled, comparative local anesthetic blocks to accurately identify facet joint pain and false-positive rates with a single block.	Age groups and controlled diagnostic medial branch blocks using 1% lidocaine or 0.25% bupivacaine, 0.5 mL per medial branch, on 2 separate occasions, usually 3 to 4 weeks apart were performed in patients with multiple psychological issues or without any psychological issues. A positive response was considered at least an 80% reduction of pain with the ability to perform previously painful movements.	No psychopathology: Prevalence = 28% False-positive rate = 58% No depression: Prevalence = 30% False-positive rate = 55% Major depression: Prevalence = 43% False-positive rate = 39% No generalized anxiety disorder Prevalence = 30% False-positive rate = 55% Generalized anxiety disorder: Prevalence = 42% False-positive rate = 40% No somatization disorder: Prevalence = 39% False-positive rate = 46% Somatization disorder: Prevalence = 38% False-positive rate = 42%	The study included a large proportion of patients with controlled, comparative local anesthetic blocks in a private practice setting.

Table 5 (cont.). Study characteristics of published reports of cervical facet joint blocks evaluating various factors influencing diagnostic accuracy.

Study/Methods	Participants	Objective(S)	Intervention(S)	Result(S)	Conclusion
Wasan et al, 2009 (205) Prospective	In a prospective cohort evaluation, 86 patients were included, differentiated into low, moderate, and high psychopathology groups with spinal pain in patients undergoing lumbar or cervical medial branch blocks. The inclusion criteria were that chronic axial neck pain with radiation of pain in a common pattern for facet syndrome, documentation of facet loading signs, or paraspinal tenderness, relevance supporting radiographic studies suggesting facet arthropathy.	Psychological evaluation and medial branch blocks with a mixture of 0.25% bupivacaine, 0.5 mL at each level, with a mixture of methylprednisolone with a total of 1 to 1.25 mL injectate volume per level with a single block.	The medial branch block procedure was performed at 3 or 4 levels in the cervical spine, using local anesthetic at each level (1 to 2 mL of 0.5% lidocaine for skin and subcutaneous infiltration) without sedation at each level. The injections consisted of methylprednisolone, 20-30 mg (0.5 to 7.5 mL) and 0.25% bupivacaine (0.5 mL) at each level, with a total of 1.25 mL injected volume per level. No positive response was defined. Only assessment of relief.	Prevalence = NA False-positive rate = NA	Response rate was only 52% from 166 participants with 86 patients responding. There was no definition of successful block. Further, a single block was performed in a university setting, even though the response rate was extremely poor. The low psychopathology group reported a mean of 23% improvement in pain at one month, while the high psychopathology group reported a mean worsening in pain. The results of this study may not be applicable to clinical practice
Cohen et al, 2010 (206) Randomized	24 patients with chronic neck pain were allocated to receive cervical medial branch blocks. Patients were selected with predominance of axial cervical pain for more than 3 months, with failure to respond to conservative therapy, and asymmetry in laterality.	To determine whether reducing the volume for cervical medial branch blocks can enhance the specificity. This study was conducted in an academic setting.	24 patients were randomly allocated into 2 groups with 0.25 mL or 0.5 mL of 0.375% bupivacaine, either in the lateral position or prone position.	Prevalence = 55% with low volume and 25% with high volume.	A very small proportion of patients were included with 12 patients in each group. The results are perplexing in that volume spread and the specificity of the blocks had no relevance to positive response.
Manchikanti et al, 2004 (208) Randomized, double blind	The study was undertaken in an interventional pain management practice with inclusion of 180 patients randomized into 3 groups. All patients suffered with neck pain and have undergone diagnostic and therapeutic facet joint nerve blocks.	To evaluate the effective of midazolam and fentanyl on the validity of diagnosis of cervical facet joint pain in a randomized, double-blind, placebo-controlled evaluation.	All patients underwent controlled diagnostic blocks and subsequently therapeutic facet joint nerve blocks. Patients presented to the center on return of pain for further treatment. Outcomes were considered as 80% pain relief with the ability to perform previously painful movements after administration of either sodium chloride solution, midazolam, or fentanyl intravenously.	≥ 80% Pain relief Placebo = 5% Midazolam = 8% Fentanyl = 8% Pain relief of 50% to 79% Sodium chloride solution = 8% Midazolam = 13% Fentanyl = 27%	This study showed that when higher relief (80%) is utilized, the false-positive rate of diagnostic cervical facet joint nerve blocks is extremely low with 8% in midazolam and fentanyl groups compared to 5% in the placebo group. At 50% to 79% pain relief there was a higher proportion with 8%, 13%, and 27% with positive response. The advantages of this study are practical setting in patients already have been diagnosed with facet joint pain.

Table 5 (cont.). Study characteristics of published reports of cervical facet joint blocks evaluating various factors influencing diagnostic accuracy.

Study/Methods	Participants	Objective(S)	Intervention(S)	Result(S)	Conclusion
Manchikanti et al, 2006 (209) Randomized, double blind	60 patients with involvement of both cervical and lumbar regions with facet joint pain were included in a placebo-controlled, double-blind, randomized evaluation. All patients suffered with chronic neck pain which was confirmed by dual diagnostic blocks.	To assess the effects of midazolam and fentanyl on the diagnostic validity of facet joint blocks in patients suffering with both cervical and lumbar facet joint pain.	All patients underwent diagnostic facet joint nerve blocks and were considered in the therapeutic phase of facet joint pain in both regions being treated with therapeutic facet joint nerve blocks.	Overall 50% of the patients in the placebo group and 100% of the patients in the midazolam and fentanyl groups were relaxed or sedated. Greater than 80% relief was observed in 5% of the patients in the placebo group, 10% in the midazolam group, and 10% in the fentanyl group. Greater than 50% relief was observed in 5% in the placebo group, 15% in the midazolam group, and 1.5% in the fentanyl group.	This study is unique in that it evaluated both cervical and lumbar facet joint pain with no significant difference noted in the diagnostic validity whether midazolam or fentanyl is utilized with 80% as the criterion standard. With 50% pain relief as the criterion standard, 15% of the patients in the cervical region reported pain relief.
Manchikanti et al, 2008 (210) Retrospective	Data were evaluated from 438 patients with chronic spinal pain who underwent diagnostic facet joint nerve blocks based on the level of opioid use with no opioid use, low opioid use, moderate opioid use, and high opioid use.	To determine the influence of prior opioid use on the diagnostic validity of controlled, comparative local anesthetic blocks in the diagnosis of facet joint involvement in chronic spinal pain.	Controlled diagnostic medial branch blocks using 1% lidocaine or 0.25% bupivacaine, 0.5 mL per medial branch were performed on 2 separate occasions, usually 3 to 4 weeks apart. A positive response was considered at least an 80% reduction of pain with the ability to perform previously painful movements.	No opioid use: Prevalence = 33% False-positive rate = 53% Heavy opioid use: Prevalence = 37% to 53% False-positive rate = 38%	This study evaluated the influence of prior opioid exposure on diagnostic facet joint nerve blocks. This appears to be the first study performed in a large proportion of patients in a private practice setting with controlled, comparative local anesthetic blocks

**2.6.2 Single Block with 75% to 100% Relief**

There were 2 studies meeting the inclusion criteria evaluating cervical facet joint pain using a cutoff threshold between 75% and 100% relief following a single block, by the same authors (159,204). They evaluated neck pain in combination with discography and diagnostic cervical medial branch blocks in patients sustaining chronic neck pain after a motor vehicle injury. The prevalence in this group was 64% in one study (204) and definitively 23% and probably 64% in the other study.

**2.6.3 Controlled Blocks with 75% to 100% Relief**

There were a total of 9 studies meeting the inclusion criteria (23-25,27,29,30,32,33,78). One study evaluated only false-positive rates (78).

Using between 75% and 100% pain relief as the criterion standard with controlled diagnostic blocks has been advocated by some as the most rigorous means for diagnosing cervical facet joint pain.

Among the 8 studies assessing the prevalence (23-25,27,29,30,32,33), all of them utilized 80% or more relief as the criterion standard except for one study (29) that utilized ≥ 75% as the criterion standard. The prevalence of facet joint pain in these studies varied from 39% to 60% in heterogenous population.

**2.7 Factors Affecting Diagnosis**

Eight studies were available to evaluate the multiple factors affecting the diagnosis of cervical facet joint pain (26,28,31,205,206,208-210). Among these, one study evaluated the age-related prevalence of cervical facet joint pain (26), 2 studies evaluated the influence of psychological factors (31,205), one study evaluated the diagnostic volume (206), 2 studies evaluated the role of sedation (208,209), and one study evaluated the role of opioid usage on the validity of the diagnostic facet joint nerve blocks (210).

**2.8 Level of Evidence**

Based on the USPSTF criteria, the evidence was classified as either good, fair, and limited or poor.

Table 6. *Clinical relevance of included studies.*

Manuscript Author(s)	A) Patient description	B) Description of interventions and treatment settings	C) Clinically relevant outcomes	D) Clinical importance	E) Benefits versus potential harms	Total Criteria Met
Yin & Bogduk (23)	+	+	+	+	+	5/5
Manchukonda et al (24)	+	+	+	+	+	5/5
Manchikanti et al (25)	+	+	+	+	+	5/5
Manchikanti et al (26)	+	+	+	+	+	5/5
Manchikanti et al (27)	+	+	+	+	+	5/5
Manchikanti et al (28)	+	+	+	+	+	5/5
Manchikanti et al (29)	+	+	+	+	+	5/5
Speldewinde et al (30)	+	+	+	+	+	5/5
Manchikanti et al (31)	+	+	+	+	+	5/5
Barnsley et al (32)	+	+	+	+	+	5/5
Lord et al (33)	+	+	+	+	+	5/5
Barnsley et al (78)	+	+	+	+	+	5/5
Aprill & Bogduk (159)	+	+	+	+	+	5/5
Bogduk & Aprill (204)	+	+	+	+	+	5/5
Wasan et al (205)	+	+	-	-	-	2/5
Cohen et al (206)	+	+	-	-	+	3/5
Manchikanti et al (208)	+	+	+	+	+	5/5
Manchikanti et al (209)	+	+	+	+	+	5/5
Manchikanti et al (210)	+	+	+	+	+	5/5

+ = positive; - = negative; U = unclear

Scoring adapted from Staal JB, et al. Injection therapy for subacute and chronic low-back pain. *Cochrane Database Syst Rev* 2008; 3:CD001824 (192).

### 2.8.1 Single block with 50% to 74% Relief

The evidence is limited based on one study with a single block with 50% to 74% pain relief as the criterion standard (206).

### 2.8.2 Single Block with 75% to 100% Relief

The evidence for a single block with 75% to 100% relief as the criterion standard is limited based on the results of two studies from the same group of authors (159,204).

### 2.8.3 Dual Blocks with 50% to 74% Relief

No studies were available in this category.

### 2.8.4 Controlled Blocks with 75% to 100% Relief

The evidence for controlled diagnostic blocks with 75% to 100% relief as the criterion standard is good

based on 9 high-quality studies (23-25,27,29,30,32,33,78) in a heterogeneous group of neck pain patients.

### 2.8.5 Summary of Evidence

Overall, when 75% or greater relief is utilized as the criterion standard with controlled blocks, the evidence is good based on multiple high quality studies of diagnostic accuracy incorporating prevalence with or without false positive rates. The evidence is limited or not available with all other categories.

## 3.0 COMPLICATIONS

Complications from intraarticular injections, medial branch blocks, or radiofrequency thermoneurolysis in the cervical spine are exceedingly rare (2,34,43,83-85,88,89,92-96,157-160,211-244). However, serious complications with cervical facet joint injections may



Table 7. Methodological quality assessment of diagnostic accuracy studies utilizing Quality Appraisal of Diagnostic Reliability checklist.

	Yin and Bogduk (23)	Manchukonda et al (24)	Manchikanti et al (25)	Manchikanti et al (26)	Manchikanti et al (27)	Manchikanti et al (28)	Manchikanti et al (29)	Speldewinde et al (30)	Manchikanti et al (31)	Barnsley et al (32)	Lord et al (33)
1. Was the test evaluated in a spectrum of subjects representative of patients who would normally receive the test in clinical practice?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
2. Was the test performed by examiners representative of those who would normally perform the test in practice?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
3. Were raters blinded to the reference standard for the target disorder being evaluated?	N	N	N	N	N	N	N	N	N	N	N
4. Were raters blinded to the findings of other raters during the study?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
5. Were raters blinded to their own prior outcomes of the test under evaluation?	N	N	N	N	N	N	N	N	N	N	N
6. Were raters blinded to clinical information that may have influenced the test outcome?	N	N	N	N	N	N	N	N	N	N	N
7. Were raters blinded to additional cues, not intended to form part of the diagnostic test procedure?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
8. Was the order in which raters examined subjects varied?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
9. Were appropriate statistical measures of agreement used?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
10. Was the application and interpretation of the test appropriate?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
11. Was the time interval between measurements suitable in relation to the stability of the variable being measured?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
12. If there were dropouts from the study, was this less than 20% of the sample.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
<b>TOTAL</b>	9/12	9/12	9/12	9/12	9/12	9/12	9/12	9/12	9/12	9/12	9/12

Y=yes; N=no; U=unclear; N/A=not applicable

Lucas N, Macaskill P, Irwig L, Moran R, Bogduk N. Reliability of physical examination for diagnosis of myofascial trigger points. *Clin J Pain* 2008; 25:80-89 (166).

Table 7 (cont.). *Quality Appraisal of Diagnostic Reliability checklist.*

	Barnsley et al (78)	Aprill & Bogduk (159)	Bogduk & Aprill (204)	Wasan et al (205)	Cohen et al (206)	Manchikanti et al (208)	Manchikanti et al (209)	Manchikanti et al (210)
1. Was the test evaluated in a spectrum of subjects representative of patients who would normally receive the test in clinical practice?	Y	Y	Y	Y	Y	Y	Y	Y
2. Was the test performed by examiners representative of those who would normally perform the test in practice?	Y	Y	Y	Y	Y	Y	Y	Y
3. Were raters blinded to the reference standard for the target disorder being evaluated?	N	N	N	N	N	N	N	N
4. Were raters blinded to the findings of other raters during the study?	Y	Y	Y	N	N	Y	Y	Y
5. Were raters blinded to their own prior outcomes of the test under evaluation?	N	N	N	N	N	N	N	N
6. Were raters blinded to clinical information that may have influenced the test outcome?	N	N	N	N	N	N	N	N
7. Were raters blinded to additional cues, not intended to form part of the diagnostic test procedure?	Y	Y	Y	Y	Y	Y	Y	Y
8. Was the order in which raters examined subjects varied?	Y	Y	Y	Y	Y	Y	Y	Y
9. Were appropriate statistical measures of agreement used?	Y	U	U	U	U	Y	Y	Y
10. Was the application and interpretation of the test appropriate?	Y	Y	Y	Y	Y	Y	Y	Y
11. Was the time interval between measurements suitable in relation to the stability of the variable being measured?	Y	N	N	N	N	N	N	Y
12. If there were dropouts from the study, was this less than 20% of the sample.	Y	NA	NA	N	NA	Y	Y	Y
<b>TOTAL</b>	<b>9/12</b>	<b>6/12</b>	<b>6/12</b>	<b>5/12</b>	<b>5/12</b>	<b>8/12</b>	<b>8/12</b>	<b>9/12</b>

Y=yes; N=no; U=unclear; N/A=not applicable  
 Lucas N, et al. Reliability of physical examination for diagnosis of myofascial trigger points. *Clin J Pain* 2008; 25:80-89 (166).

Table 8. Data of prevalence and false-positive rates of pain of cervical facet joint origin based on diagnostic blocks.

Study	% Relief Used	Methodological Criteria Score	Number of Subjects	Prevalence Estimates with 95% Confidence Intervals	False-Positive Rate with 95% Confidence Intervals
<b>50% - 74% with Single Block</b>					
Cohen et al (206)	> 50%	5/12	24	55% with low volume and 25% with high volume	NA
<b>75%-100% with Single Block</b>					
Aprill & Bogduk (159)	≥ 90%	6/12	318	25%-63%	NA
Bogduk & Aprill (204)	≥ 90%	6/12	56	41%-64%	NA
<b>75%-100% with Controlled Blocks</b>					
Yin and Bogduk (23)	> 80%	9/12	143	55%* (95% CI, 38%, 62%)	NA
Manchukonda et al (24)	> 80%	9/12	251 of 500	39% (95% CI, 32%, 45%)	45% (95% CI 37%, 52%)
Manchikanti et al (25)	> 80%	9/12	255 of 500	55% (95% CI, 49%, 61%)	63% (95% CI 54%, 72%)
Manchikanti et al (27)	> 80%	9/12	120	67%(95% CI 58% , 75%)	63%(95% CI 48% , 78%)
Manchikanti et al (29)	> 75%	9/12	106	60% % (95% CI, 50%, 70%)	40% % (95% CI, 34%, 46%)
Speldewinde et al (30)	> 90%	9/12	97	36% (95% CI, 27%, 45%)	NA
Barnsley et al (32)	> 90%	9/12	50	54% (95% CI, 40%, 68%)	NA
Lord et al (33)	> 90%	9/12	68	60% (95% CI, 46%, 73%)	NA
Barnsley et al (78)	> 90%	9/12	55	NA	27% (95% CI, 15%, 38%)

NA = not available or not applicable; CI = confidence interval; \* = adjusted

occur. Complications include those related to placement of the needle, and those related to the administration of various drugs.

The proximity of the needle to the vertebral artery, spinal cord, and nerve root creates risk for injury and makes precise and accurate needle placement exceedingly important. Complications may include dural puncture, spinal cord trauma, subdural injection, neural trauma, injection into the intervertebral foramen and intravertebral arteries; intravascular injection into veins or vertebral arteries; infectious complications including epidural abscess and bacterial meningitis; and side effects related to the administration of steroids, local anesthetics, and other drugs.

Okada (231) showed that in a series of cervical facet joint injections, a communicating pathway existed in 80% of subjects between the facet joint and interlaminar space, the opposite facet joint, extradural space, and interspinous space when volumes in excess of 1 mL were used.

Vertebral artery and ventral ramus damage, along with a risk of embolus resulting in serious neurological sequelae with spinal cord damage and cerebral infarction are exceedingly rare, but are potential complica-

tions with cervical facet joint injections.

Other minor complications include lightheadedness, flushing, sweating, nausea, hypotension, syncope, pain at the injection site, and headaches. Side effects related to the administration of steroids are generally attributed to the chemistry or to the pharmacology of the steroids (229). These include suppression of pituitary-adrenal axis, hyperadrenocorticism, Cushing's syndrome, osteoporosis, avascular necrosis of the bone, steroid myopathy, epidural lipomatosis, weight gain, fluid retention, and hyperglycemia.

A study by Manchikanti et al (240) included over 7,500 episodes or 43,000 facet joint nerve blocks performed under fluoroscopic guidance in an ambulatory surgery center by one of 3 physicians. Multiple side effects and complications observed with cervical facet joint nerve blocks included intravascular penetration of 20%, local bleeding in 67%, oozing in 29%, with local hematoma seen only in 2.3% of the patients with profuse bleeding, bruising, soreness, nerve root irritation, and all other effects such as vasovagal reactions observed in 1% or less of the episodes.

A spinal cord trauma or injection can lead to quadriplegia, motor weakness, loss of proprioception

and sensory function, bowel and bladder dysfunction, Brown-Sequard syndrome, and spinal cord infarction.

#### **4.0 Discussion**

This systematic review provides current evidence for the diagnostic accuracy of cervical facet or zygapophysial joint nerve blocks in managing chronic pain of facet joint origin. Based on the results of this evaluation, the evidence for diagnostic facet joint blocks utilizing at least 75% pain relief as the criterion standard with controlled diagnostic blocks is good based on USPSTF criteria. Utilizing 8 high quality studies that met the inclusion criteria, the prevalence of chronic cervical facet joint pain related to neck pain is very common, ranging from 36% to 60% in heterogenous population. The recent and largest study utilizing at least 80% pain relief as the criterion standard (24) has shown a prevalence of 39% in a heterogenous population in a practical setting in the United States. Moreover, this study also showed 95% confidence intervals of 32% to 45%, a narrow interval. In another study by the same group of authors (25), the prevalence was shown as 55%. It appears that as with increasing experience and proper selection, the prevalence may be around 40% rather than 60% as was shown in earlier studies.

In this assessment, good diagnostic evidence was derived from only the studies utilizing at least 75% pain relief as the criterion standard with controlled diagnostic blocks (23-25,27,29,30,32,33,78). This evaluation also shows that the validity of accuracy and reliability were evaluated based on diagnostic accuracy and various studies evaluating the factors influencing diagnostic accuracy (26,28,31,205,206,208-210) In fact, the effect of sedation was insignificant in cases with 80% pain relief as the criterion standard with controlled diagnostic blocks in influencing the diagnosis of facet joint pain, whereas it was significant when 50% pain relief was used as the criterion standard resulting in a much higher positive response and potentially false-positive results.

Manchikanti et al (26) evaluated the age-related prevalence and false-positive rates of facet joint involvement in chronic neck pain using controlled comparative local anesthetic blocks. Patients were divided into 6 groups with Group I from 18 to 30 years, Group II with 31 to 40 years, Group III from 41 to 50 years, Group IV from 51 to 60 years, Group V from 61 to 70 years, and Group VI over 70 years. The prevalence of cervical facet joint pain was 42% with a false-positive rate of 40% in Group I, 35% and 45% in Group II, 40% and 39% in

Group III, 41% and 43% in Group IV, 36% and 58% in Group V, and 33% and 56% in Group VI. Surprisingly, the lowest prevalence was noted in patients over 70 years of age, followed by patients aged 31 to 40 years with 33% and 35%.

Psychological factors were evaluated in 2 studies (31,205). The study by Manchikanti et al (31) assessed the influence of psychopathology (depression, generalized anxiety disorder, somatization disorder individually or in combinations of multiple psychopathologic conditions) on the ability of controlled, comparative local anesthetic blocks to accurately identify facet joint pain and false-positive rates with a single block. In the cervical spine, the prevalence was 28% with a false-positive rate of 58% in patients with no psychopathology, whereas the prevalence was 43% with a false-positive rate of 39% in patients with major depression and 55% in patients without major depression which was statistically significant; 42% prevalence and 40% false-positive rate in patients with generalized anxiety disorder compared to 30% and 55% in patients without generalized anxiety disorder; and prevalence was 38% with a false-positive rate of 40% in patients with somatization disorder, whereas it was 39% and 46% in patients without somatization disorder. Most importantly, somatization disorder has consistently yielded a greater number of unreliable results. That was not the case in this study. In essence, only the significant differences were noted with prevalence, as well as with false-positive rates in patients with or without major depression (43% vs. 30% and 39% vs. 55%).

The study by Wasan et al (205) was poorly conducted without appropriate controlled diagnostic blocks and outcome parameters. They described patients with low, moderate, or high levels of psychopathology. The facet joint blocks were performed with a single block with high volumes in a small proportion of patients. The low psychopathology group reported a mean of 23% improvement in pain at one month, whereas high psychopathology group reported a worsening of 6% pain. No conclusions could be drawn from this evaluation.

Manchikanti et al (28) also evaluated the prevalence of facet joint pain in postsurgical and non-surgical patients in the cervical spine with controlled comparative local anesthetic blocks. The prevalence of cervical facet joint pain and a false-positive rate of single blocks in postsurgical patients were 36% and 50% compared to 39% and 43% in non-surgical patients. Thus, there was no difference in the prevalence of these patients in the cervical spine. However, the prevalence of facet

joint pain in the lumbar spine in postsurgical patients has been shown to be lower in the lumbar spine compared to non-surgical patients (24,25).

In one study, Cohen et al (206) evaluated the influence of low dose and high dose volumes 0.25 mL or 0.5 mL of bupivacaine in producing the specific blockade. However, the group with 0.5 mL showed a prevalence of cervical facet joint pain with positive results of 25%, whereas the low volume group showed a prevalence of 55% with an injection of 0.25 mL.

Manchikanti et al (210) evaluated the influence of prior opioid exposure on diagnostic facet joint nerve blocks. They assessed patients after categorizing them into 4 groups based on the level of opioid use: Group I with no opioid use, Group II with low opioid use, Group III with moderate opioid use, and Group IV with high opioid use. Controlled, comparative local anesthetic blocks were performed for the diagnosis of facet joint pain. The study showed that prior and current opioid use was not linked to the diagnostic validity of controlled, comparative local anesthetic blocks. In the cervical spine, the prevalence was 33% in the no opioid group with a false-positive rate of 53% in contrast to 40% and 41% in the low opioid group, 37% and 45% in moderate opioid group, and 53% and 38% in the high opioid group. Even though the high opioid group appears to be positive in a larger proportion of patients, there were no significant differences noted among the groups. However, it appears that there is a trend of increased prevalence of facet joint pain or at least the diagnosis of prevalence of facet joint pain in patients receiving high opioid dosages. In an evaluation of the role of sedation, 2 studies were conducted evaluating the effect of sedation in the diagnosis of cervical facet joint pain utilizing 80% pain relief as the criterion standard (208,209). Both studies showed no significant difference when 80% or higher pain relief was utilized as the criterion standard between placebo, midazolam, and fentanyl, however, the differences became significant when a 50% criterion standard was used with a significantly high proportion of patients reporting positive results in the fentanyl group. Thus, it is advisable not to use opioids or narcotics during the diagnosis. However, it appears that with the 80% criterion standard, even fentanyl has no significant influence at the present time based on the present studies (208,209).

Finally, Barnsley et al (245) assessed the utility of randomized, double-blind, controlled, comparative local anesthetic blocks for the diagnosis of cervical zygapophysial joint pain. In this evaluation, the blocks

were performed using either lidocaine or bupivacaine, randomly allocated, and the patients' responses were assessed in a double-blind fashion. Any positive response was subsequently assessed by repeating the block with the complementary anesthetic. Only those patients experiencing a longer period of pain relief from the bupivacaine were considered to have true-positive responses. Consequently, the authors concluded that comparative, diagnostic blocks are a valid technique in the identification of painful zygapophysial joints, and constitute an implementable alternative to normal saline controls. Not surprisingly, a subgroup of 13 of 47 patients experienced unexpected prolonged responses to one or both of the local anesthetics. This systematic review illustrates the role of therapeutic cervical facet joint nerve blocks with fair evidence, which was illustrated initially in some patients in 1993 (245). In addition, Lord et al (246) also assessed the utility of comparative local anesthetic blocks versus placebo-controlled blocks for the diagnosis of cervical facet joint pain. Fifty consecutive patients referred for an assessment of chronic neck pain underwent 3 blocks using 3 different agents – lignocaine, bupivacaine, and normal saline – administered on separate occasions, in random order and under double-blind conditions. The diagnostic decision based on comparative blocks alone was compared with the based on placebo-controlled blocks. The results illustrated that comparative local anesthetic blocks were found to have a specificity of 88%, but only marginal sensitivity with 54%. Thus, comparative blocks result in few false-positive diagnoses, but they also may result in a high proportion of false-negative diagnoses. However, this study also showed that expanding the comparative blocks diagnostic criteria to include all patients with reproducible relief, irrespective of duration, increases sensitivity 100%, but lowers the specificity to 65%.

Assessment, grading the quality of evidence and providing recommendations for diagnostic tests and strategies are important in all branches of medicine, but specifically in interventional pain management (26,28,31,164,165,174,179,180-184,194-203,247). Clinicians often use diagnostic tests as a package or strategy. Interventional pain physicians use a diagnostic strategy that includes signs and symptoms and imaging to identify physiological derangements, establish prognosis, monitor illness, and diagnose (174,175). Consequently, it has been recommended by Schünemann et al (174) that guideline panels considering a diagnostic test or strategy should begin by identifying the patients, diagnostic

intervention (strategy), comparison, and outcomes of interest (176). The accuracy of a diagnostic test based on sensitivity and specificity classifies patients correctly as having or not having a disease. The underlying assumption is, however, that obtaining a better idea of whether a target condition is present or absent will result in an improved outcome. Thus, if a test is already available, a new test presumably with superior accuracy must be tested in a randomized controlled trial (RCT) in which investigators randomize patients to experimental or control diagnostic approaches and measure pain relief, functional status, quality of life improvement, and morbidity (177). To compare the impact of alternative diagnostic strategies on patient-important outcomes, guideline panels can use the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach (248,249). When such studies are not available, guideline panels must focus on studies of test accuracy and make inferences about the likely impact on patient-important outcomes (178). Thus far in the diagnosis of cervical facet joint pain only one diagnostic strategy is available — controlled diagnostic blocks. This strategy has been proven to be accurate since conventional clinical and radiological techniques, pain patterns, and physical examination findings have been shown to be less than reliable in the diagnosis of facet joint pain (97-142). Even then, controlled comparative local anesthetic blocks have faced significant criticism often based on personal philosophy (97,101). The effect of placebo and nocebo and controversy arising from these effects continues to be misunderstood and widely misinterpreted (250-258). Furthermore, a therapeutic effect has been illustrated with any solution injected into a closed space, such as an intraarticular space, or epidural space, or over a nerve, and this not been appropriately taken into consideration in interpreting the results. In fact, multiple studies have illustrated a significant effect for sodium chloride solution, either injected into the epidural space, intra-articularly, or over the nerves (181,184,258-261). In addition, a multitude of differences have been published with injection of either sodium chloride solution or dextrose, both considered as placebo (181,184,262-266). Further, the consideration of local anesthetic injections as placebo is also questionable, and published evidence shows a multitude of studies showing long lasting effectiveness of local anesthetics, as well as steroids, with many similarities between them (267-298). Factors that decrease the quality of evidence for studies of diagnostic accuracy include study design and risk of bias. Other

indirect factors include outcomes, patient populations, diagnostic tests, comparison tests and indirect comparisons, important inconsistencies in study results, imprecise evidence, and a high probability of publication bias (164,174,165,181-184). We have attempted in our systematic review to consider all these aspects with the utilization of appropriate and strict inclusion criteria and methodological quality assessment. However, the weakness continues to be with the lack of a criterion standard based on the tissue biopsy. The criterion standard utilized here that has yielded the best evidence is a controlled diagnostic block with at least 75% pain relief and the ability to perform painful movements. This has been supported by significant improvement in patients when the diagnosis was made appropriately and treatment with either medial branch blocks or radiofrequency neurotomy was provided (34,79,80,94-96).

The diagnosis of facet joint pain by controlled local anesthetic blocks is considered as valid. Controlled diagnostic blocks with 2 local anesthetics with placebo control are the only means of confirming the diagnosis of facet joint pain. The face validity of cervical medial branch blocks has been established by injecting small volumes of local anesthetic and contrast material onto the target points. Construct validity of cervical facet joint blocks is important to eliminate placebo effect as a source of confounding results and to secure true-positive results (23-29,32,33,164,179,183,184). Further, the hypothesis that testing a patient first with lidocaine and subsequently with bupivacaine provides a means of identifying that the placebo responses have been tested (245,246,299).

Controlled comparative local anesthetic blocks are easier to implement in a conventional practice and, therefore, are likely to be preferred and used by physicians unable to perform placebo-controlled blocks specifically in the United States. Moreover, when compared with placebo-controlled blocks, the false-positive rate has been shown to be very low (246). Therefore, a diagnosis based on comparative blocks is unlikely to be wrong. Cohen et al (207), by proposing a single block, only strengthened rather than weakened the value of comparative local anesthetic blocks (300). The lack of influence of psychological variables (205), age (26), opioid exposure (210), previous surgery (28), and sedation (208,209) have been published.

Consequently, we believe that the present systematic review provides good evidence in favor of controlled diagnostic blocks in diagnosing cervical facet joint pain with a criterion standard of 75% pain relief

and the ability to perform multiple maneuvers which were painful prior to diagnostic blockade.

In conclusion, the evidence is good or strong for accuracy of diagnostic facet joint nerve blocks in the diagnosis of chronic cervical facet joint pain with at least 75% relief with controlled diagnostic blocks.

## 5.0 CONCLUSION

Diagnostic cervical facet joint nerve blocks are safe, valid, and reliable. Based on the review of available studies that met inclusion criteria, the strength of evidence for diagnostic facet joint nerve blocks is good with at least 75% relief with controlled diagnostic blocks.

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