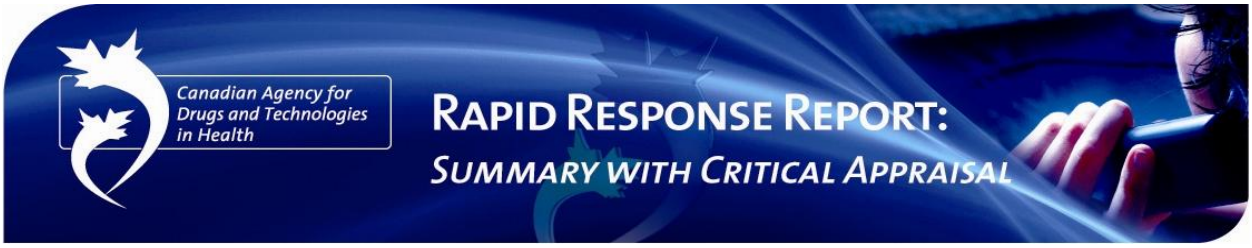

TITLE: Facet Joint Injection as Diagnostic and Therapeutic Tools for Pain of the Cervical and Lumbar Spine: A Review of Clinical and Cost-Effectiveness

DATE: 25 January 2011

CONTEXT AND POLICY ISSUES

Low back pain (LBP) affects 80% of Canadians at some point in their lives and is associated with a substantial clinical and economic burden.[1,2] Low back pain can interfere with social activities and ability to function at work.[2] Risk factors for LBP include sedentary lifestyle, obesity, poor muscle tone and posture; and using improper lifting techniques and heavy lifting.[2,3] Often, the underlying anatomical source of LBP can be difficult to identify and in the majority of individuals with LBP, the source of the pain will remain unidentified following clinical work-ups and imaging studies.[1,4]

The facet joints are a source of LBP in about 15% of cases.[5] The spine contains 25 pairs of facet joints, which are small joints that stabilize the spine and help to control motion between adjacent vertebrae.[6-8] The facet joints can become painful as a result of osteoarthritis, injury to the back or mechanical strain.[6-8] The facet joints of the lumbar and cervical spine are more likely to be affected by arthritis than other segments of the spine, such as the thoracic region.[7,8]

Facet joint injections (FJIs) are used to determine if the facet joints are the underlying cause of spinal pain (i.e. as a diagnostic tool) and have also been used as means of treating LBP or neck pain that does not respond to conventional treatment (i.e., as a therapeutic tool).[6] Diagnostic FJIs involve injecting local anesthetic with or without steroids directly in to the facet joint space under fluoroscopic guidance.[6] Pain relief suggest that the facet joint is the pain source. Therapeutic FJIs can potentially provide longer-term pain relief, but the long-term response rate (e.g. up to six months) is variable (18% to 63%).[6]

The diagnostic accuracy, safety and long-term therapeutic benefit of facet joint injections is unclear.[9] This report will review the evidence of the diagnostic accuracy, clinical effectiveness and safety of FJIs for pain of the cervical and lumbar spine. This information could aid in decisions about individual patient management and more broadly in policy decisions about FJIs.

RESEARCH QUESTIONS

1. What is the evidence on the clinical effectiveness and safety of facet joint injections as diagnostic and therapeutic tools for pain of the cervical and lumbar spine?

2. What is the evidence on the cost-effectiveness of facet joint injections as diagnostic and therapeutic tools for pain of the cervical and lumbar spine?

KEY MESSAGE

The body of evidence included in this rapid review was comprised of one health technology assessment (HTA) report, six systematic reviews, one randomized controlled trial (RCT) and five non-randomized studies. Overall, evidence of the diagnostic accuracy and clinical effectiveness of lumbar and cervical facet joint injections is conflicting and subject to a number of limitations. As such, the diagnostic accuracy and clinical effectiveness of lumbar and cervical facet joint injections remains largely unknown.

METHODS

A limited literature search was conducted on key health technology assessment resources, including PubMed, The Cochrane Library (Issue 1, 2011), University of York Centre for Reviews and Dissemination (CRD) databases, ECRI (Health Devices Gold), EuroScan, international health technology agencies, and a focused Internet search. The search was limited to English language articles published between January 1st, 2006 and January 6th, 2011. Filters were applied to limit the retrieval to health technology assessments, systematic reviews, meta-analyses, randomized controlled trials, non-randomized studies, safety data, economic studies, and guidelines.

Studies that assessed the effectiveness of therapeutic and diagnostic FJIs in patients with neck or low back pain were eligible for inclusion in this rapid review. The interventions of interest were FJIs directly into the joint (intraarticular) with steroids, local anesthetics, and hyaluronic acid. Placebo controlled studies and those with active comparators were eligible for inclusion. Outcomes of interest included measures of diagnostic accuracy, clinical effectiveness (pain relief, functional status, disability) and cost-effectiveness (e.g. cost per quality adjusted life year gained).

Rapid response reports are organized so that the higher quality evidence is presented first. Therefore, health technology assessment reports, and systematic reviews are presented first. These are followed by randomized controlled trials and non-randomized studies.

SUMMARY OF FINDINGS

One relevant health technology assessment report,[2] eight publications of six systematic reviews (two of the systematic reviews were published in two different sources),[9-16] one randomized controlled trial (RCT)[17] and five non-randomized studies[18-22] were identified by the literature search. In addition, a previous CADTH Rapid Review of FJIs was conducted in 2007 and is not summarized in the present report.[23]

Health technology assessments

In 2006, the Belgian Health Care Knowledge Centre (KCE) published a HTA report on interventions for managing chronic back pain, including facet joint injections.[2] A systematic search of the literature was used to identify relevant literature including guidelines, systematic reviews and RCTs that were not captured in the included systematic reviews. Quality of the identified reports was assessed using standard tools from AGREE and the Cochrane Collaboration. The conclusions regarding each intervention were assigned levels of evidence. Other details of the methodology were not reported.

Diagnostic FJIs

For diagnostic FJIs, evidence from two guidelines (published in 2005 and 2006) and one systematic review (published in 2005) were included. The included evidence from one guideline suggested that the reproducibility of FJIs was low and that the specificity was about 65%, which lead to the authors of this guideline to conclude that moderate-quality evidence indicated that FJIs were not reliable for diagnosing facet joint pain. Conversely, evidence from the other included guideline lead to the conclusion that there was strong evidence of the diagnostic validity, specificity and sensitivity of FJIs. This guideline reported complications of diagnostic FJIs to be dural puncture, spinal cord trauma, infection, intravascular injection, spinal anesthesia, chemical meningitis, neural trauma, and hematoma formation, steroids side effects, radiation exposure, and facet capsule rupture but the frequency with which such effects occurred was not reported. The systematic review of diagnostic FJIs included six RCTs that were rated as being of good quality according to the Cochrane Collaboration Tool. No evidence from the individual included studies was reported, other than complications of vaso-vagal episodes and procedure-related discomfort in one study. The authors of the systematic review concluded that facet joint injections for diagnostic purposes were reproducible, reasonably accurate and safe.

Based upon the evidence of diagnostic FJIs, the KCE HTA authors stated that validity and reliability of the evidence was low and the results were conflicting. They further stated that the favourable conclusions of the one guideline and systematic review appeared to come from the same group of researchers and it was unclear if the results were generalizable.

Therapeutic FJIs

The body of evidence that was included in the assessment of therapeutic FJIs was comprised of three systematic reviews, two guidelines, one good quality RCT and two low quality RCTs. The two guidelines yielded conflicting results, one stating that moderate evidence suggests that therapeutic FJIs with corticosteroids are not effective in patients diagnosed with LBP originating from the facet joints and that there was no evidence to support the use of FJIs in non-specific LBP. The other guideline stated that there was moderate evidence suggesting short-term benefit of therapeutic FJIs with corticosteroids and local anesthetics in LBP and limited evidence of long-term efficacy. This interpretation was described by the authors of the KCE HTA as being in contrast to evidence from the three systematic reviews and RCT that suggested no benefit of therapeutic FJIs in LBP. No additional safety data were presented. From this evidence, authors of the KCE HTA concluded that evidence of the safety and efficacy of therapeutic FJIs for LBP was lacking and of low quality.

Limitations

Limitations to the KCE report include a lack of clear description of the specific criteria for study selection, methodology for study selection for inclusion, data extraction, quality assessment and outcomes of the included reports. Further, there was no distinction made between cervical and lumbar spine FJIs.

Systematic reviews and meta-analyses

Details of the methodology of the included systematic reviews of diagnostic accuracy and therapeutic benefit of cervical and lumbar FJIs are summarized in Appendix 1. Two of the included systematic reviews evaluated the diagnostic accuracy of FJIs, one for lumbar FJIs[10] and one for cervical FJIs.[11] These systematic reviews also had the objective of evaluating the therapeutic efficacy of lumbar and cervical FJIs, but failed to identify any relevant studies of adequate methodological quality that met their inclusion criteria.[10,11] Of the remaining four systematic reviews, one assessed therapeutic FJIs in neck pain[13,14], two assessed therapeutic FJIs in LBP,[12,15] and one assessed FJIs in both neck and back pain.[9]

Diagnostic FJIs

The key findings of the included systematic reviews are summarized in Table 1. For diagnostic lumbar FJIs, the pooled false positive rate from seven studies was estimated to be 30% (95% CI: 27% to 33%).[10] No other estimates of diagnostic accuracy were calculated in the review. For diagnostic cervical FJIs, data were not pooled from the included studies and the false positive rates ranged from 27% to 63%.[11] Both systematic reviews of diagnostic FJIs concluded that diagnostic FJIs were safe, valid and reliable for identifying facet joint involvement in patients with back or neck pain. The two systematic reviews of diagnostic studies of FJIs[10,11] were both limited by a number of issues outlined in Table 1. Importantly, the reference or gold standard to which the diagnostic FJIs were compared was not reported. Further, important details such as the drugs injected and injection technique were not reported, making it difficult to determine with certainty whether the included studies were only those of intraarticular injections or whether some included studies evaluated nerve blocks. Finally, the conclusions of the reviews, regarding safety in particular, were not clearly supported by the evidence summarized.

Therapeutic FJIs

For therapeutic FJIs four systematic reviews[9,12,13,15] were narrative summaries of the included studies. Datta et al, 2009[10] and Falco et al, 2009[11] did not identify any studies that met their inclusion criteria for the evaluation of therapeutic FJIs. They are included in Table 1 for information purposes and because they did, however, make conclusions regarding therapeutic FJIs. For therapeutic cervical FJIs, both systematic reviews[9,13] summarized the same single RCT. There were differences in reporting of the study details (number of patients and interventions). One review reported a comparison of bupivicaine to betamethasone,[9] while the other reported the comparison to be between bupivicaine and the combination of bupivicaine and betamethasone.[13] Both reviews reported that results were similar between treatment arms and concluded that therapeutic cervical FJIs were of limited benefit.

For therapeutic lumbar FJIs, two systematic reviews reported limited to no short-term benefit[12,15] and lack of clear benefit after six months.[12,15] Both reviews concluded that there was insufficient evidence to support the use of therapeutic lumbar FJIs. The third systematic review reported

more favourable results for therapeutic lumbar FJIs and concluded that there was moderate evidence of short- and long-term pain relief with lumbar FJIs.[9] No safety data were summarized in any of the included systematic reviews.

Table 1: Key findings of included systematic reviews

Study	Included Studies	Results	Author's Conclusion	Limitations
Diagnostic Facet Joint Injections				
Datta et al, 2009[10]	Seven included studies of a total of 1420 patients (designs of studies not described). All studies rated 75/100 for quality assessment.	Pooled prevalence of Lumbar facet Joint Pain: 31% (95% CI: 28% to 33%) Pooled false positive rate: 30% (95% CI: 27% to 33%)	Diagnostic lumbar FJI are safe, valid and reliable.	Tests were not evaluated by assessors without knowledge of disease status. Reference or gold standard not reported. Details of included studies unclear (e.g. drugs or techniques used) Failure to report complication rates to support conclusions regarding safety.
Falco et al, 2009[11]	Nine included studies of a total of 1290 patients (designs of studies not described). Quality rating ranged from 50 to 75/100 points	Prevalence estimates of cervical facet joint pain ranged from 36% to 67% False positive rates ranged from 27% to 63% Data were not pooled.	Diagnostic cervical FJI are safe, valid and reliable.	Tests were not evaluated without knowledge of disease status. Reference or gold standard not reported. Details of included studies unclear No rationale for not pooling data. Failure to report complication rates to support conclusions regarding safety. The upper limit of the false positive rates seems to contradict the conclusion that FJIs are reliable.

Study	Included Studies	Results	Author's Conclusion	Limitations
Therapeutic Facet Joint Injections				
Datta et al, 2009[10]	Six RCTs identified, but none met the inclusion criteria due to lack methodological quality.	Not applicable	There is weak evidence to support the use of therapeutic intraarticular FJI for lumbar pain and weak evidence not to provide them.	Conclusions made regarding intraarticular FJIs despite none of the identified studies meeting the inclusion criteria for the review
Falco et al, 2009[11]	Two studies identified that failed to meet the inclusion criteria due to lack methodological quality.	Not applicable	There is no evidence to support the use of intraarticular cervical FJIs.	Lack of consideration of lower quality evidence in the absence of studies of higher quality
Chou et al., 2009[12]	Four systematic reviews and two RCTs (210 patients) of FJIs in lumbar pain.	Three systematic reviews found no benefit of FJI with corticosteroid compared to placebo injections. One systematic review found moderate evidence of short-term improvement with FJIs. One RCT found no difference in pain relief between steroid and placebo after 1 (RR: 0.89, 95% CI: 0.65 to 1.21) and 3 months (RR: 0.90, 95% CI: 0.69 to 1.17). One-half of those responding at six months had not previously responded at 1 or 3 months. One RCT found no difference in mean pain scores between steroid and saline FJI (data and timing of outcome assessment not reported).	There was no net benefit of FJIs over placebo, based upon evidence that was considered "fair" quality overall.	Limitations of the included trials, which the authors of the review felt could lead to an underestimate in treatment benefits (specifically the two included RCTs did not require a positive diagnostic FJI for study enrollment). No evaluation of outcomes past six month, so long-term benefit unclear. The authors stated that it was unknown why benefits of FJI would be delayed to six months post-treatment and stated this result was controversial.
Carragee et al, 2009[13,14]	One RCT of 42 patients randomized to cervical FJI with bupivicaine alone or with corticosteroid. The review authors	30% to 40% of patients in each group had a >50% reduction in FJ pain after 10 days and 10% to 15% after 90 days. No additional benefit was	Cervical FJIs with corticosteroids likely not helpful	Lack of description of methods for quality assessment, study selection, data extraction. Conclusions regarding

Study	Included Studies	Results	Author's Conclusion	Limitations
	described this study as having major weaknesses.	seen by adding corticosteroid.		cervical FJIs limited by the available evidence.
Staal et al, 2008[15] and 2009[16]	Five RCTs of intraarticular FJIs (three steroid and two combination of steroid and anesthetic) in 436 patients. Three of studies were considered to be of acceptable methodological quality.	In one study, no significant differences for self-rated improvement, pain or functional status at one and three months with steroid FJI compared to placebo. At six months, outcomes favoured the steroid group. In one study, significant differences between the groups were reported for pain, disability and work attendance up to three months between steroid FJI compared to placebo. In one study, no differences in pain and disability between combination of steroid and anesthetic with a stretching program compared to a stretching program (timing of outcome assessment not reported). In one study FJIs with steroid and anesthetic were compared with facet nerve blocks showed slightly better pain relief with FJIs at 1 month, but not at 3 months post-treatment. In one study of FJIs with steroid versus hyaluronate found no differences after six months in pain relief, disability and quality of life.	The evidence was insufficient to support the use of injection therapy in subacute and chronic LBP.	No data on adverse events. Not clear if the injections were under fluoroscopic guidance. Two of the included studies were not of acceptable methodological quality.
Boswell et al., 2007[9]	Three RCTs included (one in cervical and two in lumbar FJ	One study of 60 patients that compared hyaluronate to	The evidence for short and long term pain relief with	Limitations reported for the included RCTs such as failure to

Study	Included Studies	Results	Author's Conclusion	Limitations
	pain). All rated as being of high quality (9 to 10/10 points)	triamcinolone in lumbar pain found improved function and QOL with both treatments at 3 months and 6 months post-injection. One study of 101 patients that compared methylprednisolone to placebo in lumbar pain found marked improvement in 42% of patients in the methylprednisolone group and 33% of the placebo group after three months (not statistically significant). At six months 46% of the methylprednisolone group responded (p=0.002) One study of 41 patients with cervical pain compared bupivicaine to betamethasone and found no difference in the duration of pain relief, or median duration of time to return to pain of 50%	lumbar FJIs was moderate and with cervical FJIs was limited.	exclude placebo responders, lack of use of diagnostic blocks to identify patients eligible for inclusion, and sample sizes. Did not report on adverse effects. Details of study selection, data extraction not reported. Failure to adhere to inclusion criteria for the review (studies included that did not enroll only those patients with documented facet joint origin as determined by diagnostic facet joint blocks)

FJ – Facet joint; FJI – Facet joint injection; RCT – Randomized controlled trial; LBP – Low back pain; QOL – Quality of life

Randomized controlled trials

In 2009, Ackerman et al.[17] published an RCT that compared the clinical effectiveness of intraarticular lumbar FJIs and medial branch nerve blocks in patients with nonradicular LBP with evidence of facet joint involvement on single photon emission computed tomography (SPECT) imaging. The study population included patients with a baseline pain intensity score of 7.0 or higher on a 10-point scale, with a duration of pain of less than six months. Patients with allergies to the study medications, radicular symptoms on physical examination, pregnancy, steroid exposure within the four weeks prior, who were on anticoagulants, or had fractures or disc herniation were excluded. Patients were randomly assigned to therapeutic lumbar FJIs (n=23) or medial branch nerve blocks (n=23). For both interventions, injections containing 0.5 mL of 1% lidocaine and 8 mg of triamcinolone were used. The primary outcome measure was a 50% reduction in pain intensity, 12 weeks after baseline. The Oswestry Disability Index (ODI) was a secondary outcome measure.

After 12 weeks, 61% of the FJI group had a greater than 50% reduction in pain intensity form baseline compared to 26% of the medial branch block group ($p<0.05$). The reduction in ODI

from baseline was larger in the FJI group (19 points versus 11 points; p<0.05). The authors concluded that lumbar FJIs were more effective after 12 weeks than medial branch nerve blocks. Limitations to this study include lack of a placebo control, lack of a double blind (only patients were blinded), the 12 week duration of follow-up, failure to report adverse effects, and failure to repeat SPECT imaging to confirm the results of the patient reported outcomes. It is not clear if the results of this study would be generalizable to those with less severe pain or a history of pain duration of greater than six months.

Non-randomized studies

Five relevant non-randomized studies of therapeutic FJIs were identified.[18-22] Methodological details of these studies can be found in Appendix 2. All of the non-randomized studies were single-arm studies of patients with lumbar facet joint pain. The sample sizes ranged from 13 to 57 participants and the duration of follow-up from six weeks to 12 months. The intervention in two studies[18,19] was hyaluronic acid, an agent used for viscosupplementation, and was a combination of local anesthetic and steroid in the other three.[20-22]

The two studies of viscosupplementation yielded conflicting results regarding its clinical benefit, but the timing of the assessments were quite different (six weeks versus six or 12 months (Table 2).[18,19] One study concluded that there were benefits with viscosupplementation up to about six months,[18] while the other concluded that no benefit was observed.[19]

The three studies of the therapeutic lumbar FJIs with combinations of local anesthetic and steroid demonstrated improvements in pain six months following the procedure (Table 2).[20-22] One study found a favourable impact on disability six months following the procedure.[21] Adverse events were reported in two studies and were generally not considered serious.[21,22]

Table 2: Outcomes, conclusions and limitations of nonrandomized studies of therapeutic FJIs

Study	Outcomes	Limitations	Conclusions
Chaturvedi et al., 2009[22]	Pain VAS: Highest percentage of responders (> 50% reduction of pain) was observed at four weeks post-treatment (93.3%). This decreased to 62.5% of patients at six months post-treatment. Adverse effects: No major complications. Five patients had soreness or local bruising.	The included patients were described as “selected patients”, rather than consecutive patients. This increases the risk of selection bias and can compromise the representativeness of the sample. As there was no control group, placebo response was not controlled for, nor was the effects of other possible confounders. This is particularly problematic given the subjective nature of the outcome measures. Sample size could limit the generalizability of the results.	In patients who are carefully selected cases, lumbar FJIs are simple, safe, and minimally invasive and can be valuable in the adjunctive treatment of LBP.

Study	Outcomes	Limitations	Conclusions
		Other clinical outcomes such as disability and HRQL were not assessed. Clinical diagnosis of facet joint pain, rather than through diagnostic blocks.	
Depalma et al, 2009[18]	Pain VAS: Statistically significant improvement at six months, not maintained at 12 months. Oswestry Disability Index, SF-36, sitting, standing and walking tolerance: No improvement at 12 months Patient satisfaction: 31% still satisfied after 12 months Adverse events: most common was pain at injection site. One case of radiculopathy that resolved.	Lack of a control group FJI procedure was not well described. Lack of blinding. Sample size could limit the generalizability of the results. A convenience sample was used, which could limit the generalizability of the results. The results of this study may not be generalizable to individuals with facet joint pain, but without radiographic evidence of arthropathy.	Viscosupplementation in patients with lumbar facet joint arthropathy was associated with moderate improvements in pain and function, mainly up to six months.
Cleary et al, 2008[19]	No improvement in Pain VAS and Oswestry Disability Index after six weeks.	Lack of a control group FJI procedure was not well described. Lack of blinding. Sample size could limit the generalizability of the results. A convenience sample was used, which could limit the generalizability of the results. The results of this study may not be generalizable to individuals with facet joint pain, but without radiographic evidence of arthropathy	The findings did not demonstrate a benefit of viscosupplementation in patients with facet joint arthropathy.
Anand et al, 2007[20]	Patient reported improvement in pain: Complete relief – 31% Partial relief – 37% No relief – 31%	Lack of a control group Sample size could limit the generalizability of the results. A clinical diagnosis was used to identify patients with	Response rate suggests that FJIs have a role in the treatment of LBP. However, the likelihood of response is difficult to predict based upon clinical criteria.

Study	Outcomes	Limitations	Conclusions
	Poor correlation between clinical indicators of facet joint involvement and degree of relief was noted.	lumbar facet syndrome, rather than diagnostic FJIs or blocks. Measure of improvement was limited to one subjective rating. Failure to report adverse effects.	
Schulte et al, 2006[21]	Pain Disability Index: statistically significant improvement in all domains (family/home responsibilities, recreation, social activities, occupation, sex behaviour, self-care and life support activity). Numerical values not reported. Pain Visual Analogue Scale: Statistically significant decrease in pain (numerical values not reported) MacNab Criteria (rating of excellent, good, fair or poor results by patient): 62% rated excellent or good. Adverse Effects: 26% of patients had temporary and self-limiting adverse effects: LBP, numbness, headache, mild allergy, heartburn.	Lack of a control group Sample size could limit the generalizability of the results. A clinical diagnosis was used to identify patients with lumbar facet syndrome, rather than diagnostic FJIs or blocks.	FJIs are effective for providing temporary relief in patients with facet joint syndrome.

FJI – Facet joint injection; LBP – Low back pain; QOL – Quality of life; VAS – Visual analog scale

Limitations

The body of evidence included in this rapid review was comprised of one HTA report, six systematic reviews, one RCT and five non-randomized studies. The majority of this evidence was focused on lumbar FJIs. Lumbar FJIs for diagnostic purposes were evaluated in the HTA report and one systematic review. While the HTA report appeared to be of adequate methodologic quality, the systematic review had numerous limitations which made the validity of its findings questionable. Further, only the false-positive rate was reported as a means of assessing diagnostic accuracy. Moreover, given the lack of detail provided, it was unclear as to what specific intervention (steroid, anesthetic, combination, dose, procedure for administration) the false positive rate was applicable to. For therapeutic lumbar FJIs, evidence was included

from one HTA report, three systematic reviews, one RCT and five non-randomized studies. While HTA reports and systematic reviews are considered higher quality evidence, they were limited by the lack of methodological rigor of the included studies. The five non-randomized studies did not have comparison groups, and have a number of methodological limitations such as a higher risk of selection bias, confounding, lack of control for a placebo effect, and issues with generalizability. The included RCT also had methodological limitations as noted in its summary above.

For diagnostic cervical FJIs, one systematic review was identified, but this review had limitations to its methodology that made the conclusions somewhat questionable. For therapeutic FJIs, two systematic reviews were included, but these reviews both included only a single RCT and had discrepancies in their reporting of study details.

The literature search did not identify any studies of the cost-effectiveness of diagnostic or therapeutic FJIs, and the identified safety data were sparse. As such, a knowledge gap remains for these outcomes.

CONCLUSIONS AND IMPLICATIONS FOR DECISION OR POLICY MAKING:

There was some evidence of short-term benefit of therapeutic lumbar FJIs for relief of LBP, but evidence of longer-term benefit was unclear. The majority of this evidence was derived from patient populations that failed to respond to conventional treatment. Generalizability to the broader population with lumbar facet joint pain is unknown. For therapeutic cervical FJIs for neck pain, the identified literature does not support their use. The clinical efficacy of cervical and lumbar diagnostic FJIs was unclear from the included literature. Some evidence suggests false positive rates of approximately 30% to 60%, which could limit the clinical utility of diagnostic FJIs if the true rate is near the upper end of the range. Based on the identified literature, no conclusions can be made regarding the cost-effectiveness and safety of diagnostic or therapeutic FJIs.

Overall, evidence of the diagnostic accuracy and clinical effectiveness of lumbar and cervical FJIs is conflicting and subject to a number of limitations. Moreover, despite the same studies being included in several systematic reviews, the overall conclusions of those reports have differed. Caution should be used in applying the current body of literature to policy decisions about FJIs and decisions about individual patient management and its limitations should be considered.

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APPENDICES:

Appendix 1: Methodology of included systematic reviews of diagnostic and therapeutic FJIs for pain of the cervical or lumbar spine

Study	Objective	Eligibility Criteria	Other Methodological Details
Diagnostic Facet Joint Injections			
Datta et al, 2009[10]	To assess the clinical utility of diagnostic and therapeutic lumbar FJIs	Population: Patients with chronic lumbar facet joint pain of greater than three months. Intervention: Controlled diagnostic local anesthetic blocks under fluoroscopy guidance Comparator: not stated Diagnostic Criterion: >80% pain relief for the duration of local anesthesia with ability to perform previously painful maneuvers. Study designs: Any published clinical study, with the exception of case reports, book chapters, non-evidence-based guidelines, letters and opinion pieces.	Comprehensive and systematic literature search of Medline, EMBASE and Cochrane databases from 1966 to 2008. Quality assessment and grading according AHRQ criteria for diagnostic studies performed by two physicians. Studies with quality scores of <50 on a 0 to 100 scale were excluded.
Falco et al, 2009[11]	To assess the clinical utility of diagnostic and therapeutic cervical FJIs	Population: Patients with cervical facet joint pain of greater than three months duration. Intervention: Controlled diagnostic local anesthetic blocks under fluoroscopy guidance Comparator: not stated Diagnostic Criterion: >80% pain relief for the duration of local anesthesia with ability to perform previously painful maneuvers. Study designs: Any published clinical study, with the exception of reviews, abstracts, editorials, surveys, case reports, letters and animal or cadaveric studies.	Comprehensive and systematic literature search of Medline, EMBASE, Google Scholar and Cochrane databases from 1966 to 2008. Quality assessment according to guidelines from the U.S. Preventative Services Task Force

Study	Objective	Eligibility Criteria	Other Methodological Details
Therapeutic Facet Joint Injections			
Datta et al, 2009[10]	To assess the clinical utility of diagnostic and therapeutic FJIs	Population: Patients who met the diagnostic criterion of facet joint pain, defined as >80% pain relief for the duration of local anesthesia with ability to perform previously painful maneuvers. Intervention: Intraarticular FJI Comparator: Not stated Outcome: Outcome evaluation of at least six months. Study designs: Published clinical studies, where patients met the diagnostic criterion, with the exception of case reports, book chapters, and non-systematic reviews. If four or more RCTs were identified, NRS were excluded.	Comprehensive and systematic literature search of Medline, EMBASE and Cochrane databases from 1966 to 2008. Quality assessment by two physicians according to Cochrane review criteria for RCTs and AHQR for NRS. Studies with quality scores of > 50 on a 0 to 100 scale were included.
Falco et al, 2009[11]	To assess the clinical utility of diagnostic and therapeutic cervical FJIs	Population: Patients who met the diagnostic criterion of cervical facet joint pain, defined as >80% pain relief Intervention: Intraarticular cervical FJI Comparator: Not stated Outcome: Outcome evaluation of at least six months including pain relief, functional and psychological status, return to work, opioid use. Study designs: Not clearly stated but if four or more RCTs were identified, NRS were excluded.	Comprehensive and systematic literature search of Medline, EMBASE, Google Scholar and Cochrane databases from 1966 to 2008. Quality assessment by two physicians according to Cochrane review criteria for RCTs and AHQR for NRS. Studies with quality scores of > 50 on a 0 to 100 scale were included.
Chou et al., 2009[12]	To assess evidence on benefits and harms of nonsurgical	Population: nonpregnant adults with LBP of any duration, alone or with leg pain (acute LBP associated with trauma, infection, cancer, fracture excluded)	Systematic literature search of Ovid MEDLINE, the Cochrane Database of Systematic Reviews,

Study	Objective	Eligibility Criteria	Other Methodological Details
	therapies for the treatment of LBP as part of an evidence synthesis for guideline development.	Intervention: Many, one of which was corticosteroid injection into the facet joints. Comparator: Not stated Outcome: back specific function, health status, pain, work disability, or patient satisfaction Study Designs: RCTs and systematic reviews published before 2000	and the Cochrane Central Register of Controlled Trials up to 2008 (year searched from not mentioned) Supplemental searching of reference lists and additional citations suggested by experts. Two reviewers independently rated the quality of trials using the criteria developed by the Cochrane Back Review Group for RCTs and the Oxman and Guyatt criteria for systematic reviews. Data extraction was not performed for RCTs included in previous published systematic reviews that were considered high quality. Results for these RCTs were taken from the systematic reviews (not the original articles).
Carragee et al, 2009[13,14]	To systematically review the literature on injections and surgeries for neck pain	Population: Patients with neck pain of unexplained origin, due to whip-lash or work related injury or strain Interventions: Many, one of which was cervical FJIs but nodescription of specific drugs given Comparator: Not stated Outcomes: Diagnosis, incidence, prevalence, determinants of risk factors, prevention, prognosis, treatment course, costs. Study designs: Studies with at least 20 patients and systematic reviews	Systematic literature search of Medline from 1980 to 2005. The database search was supplemented by reviewing reference lists and updating the search for 2006 to 2007. Reviewers assessed whether studies were internally valid, but no other details provided for quality assessment.
Staal et al, 2008[15] and 2009[16]	To assess whether injection therapy is more effective than placebo or other comparators for	Population: Patients aged from 18 to 70 years with chronic (greater than 12 weeks) or subacute (greater than 4 weeks) LBP.	This was an update to a previous Cochrane review that was withdrawn (Nelemans et al).[24]

Study	Objective	Eligibility Criteria	Other Methodological Details
	patients with subacute or chronic LBP.	Intervention: Injection therapy to the facet joints for pain relief. (others as well) Comparator: Not stated Outcome: Pain had to be one of the outcomes of the studies Study Design: RCTs	Systematic literature searches of MEDLINE, EMBASE and Cochrane CENTRAL from1999 to March 2007 to update review by Nelemans et al. [24] Two authors independently reviewed studies, assessed the methodological quality, and extracted the data. Quality assessment was according to methodological criteria recommended by the Cochrane Back Review Group.
Boswell et al., 2007[9]	To provide updated evidence on the efficacy of intraarticular facet joint blocks and other facet joint interventions	Population: Patients with spinal (cervical, lumbar) pain of documented facet joint origin as determined by diagnostic facet joint blocks Intervention: Intraarticular facet joint injections (others as well) Comparator: Not stated Outcome: Outcome evaluation of at least three months including pain relief, functional and psychological status, return to work, complications. Study designs: Not specified but minimum three month duration.	Systematic search of MEDLINE and EMBASE from 2004 to 2006 and the Cochrane Database. Google also searched. Quality assessment according to Cochrane review criteria for RCTs and AHRQ for all study types. Studies with quality scores of > 50 on a 0 to 100 scale were included.

FJI – Facet Joint Injection; AHRQ – Agency for Healthcare Research and Quality; RCT – Randomized controlled trial; NRS – Non-randomized study; LBP – Low back pain

Appendix 2: Methodological details of nonrandomized studies of therapeutic FJIs

Study	Population	Intervention	Comparator	Duration of Follow-up
Chaturvedi et al., 2009[22]	44 selected patients with chronic nonradicular LBP for at least three months, not responsive to conventional treatment and symptoms suggestive of facet joint pain. Patients with neurological deficits, nerve root compression on MRI, infection, pregnancy, or on anticoagulants were excluded.	Injection of 0.5 mL of 0.25% bupivicaine and 20mg of methylprednisolone into the facet joint.	None	Six months
Depalma et al, 2009[18]	15 patients with lumbar facet joint arthropathy based on MRI findings and a positive results from diagnostic FJIs. Patients who were pregnant, had malignancy, infection, coagulopathy, allergy to study medication were excluded.	Two injections into the affected facet joint, administered 10 days apart of 1 mL of Hyalin G-F 20. Patients could have a third injection if needed.	None	12 months
Cleary et al, 2008[19]	13 patients with symptomatic lumbar facet joint arthritis. Lumbar facet joint involvement was based upon clinical criteria and on degenerative changes on MRI. Patients with psychotic disorders, history of substance abuse, use of intraarticular steroid injections in the previous three months or hyaluronic acid in the previous six months, allergies, immune disorders, malignancy, or who used anticoagulants were excluded.	Injection of 10mg of hyaluronic acid per joint.	None	Six weeks
Anand et al, 2007[20]	57 consecutive patients with LBP of at least three months duration, unresponsive to conservative treatment and referred for FJI. Patients with neurological symptoms, cancer or inflammatory conditions. Diagnosis based upon clinical criteria	20mg of depomedrone and 1 mL of 0.5% bupivicaine	None	Six months
Schulte et al, 2006[21]	39 consecutive patients with lumbar facet joint syndrome based on a clinical diagnosis. Patients with RA, radicular neurologic complaints, intolerance to the study drugs, pregnancy or coagulation disorders were excluded	Fluoroscopy guided intraarticular injection of 50 mg of prenisolone and 2 mL of 1% lidocaine	None	Six months

LBP – Low back pain; FJI – Facet joint injection; RA – rheumatoid arthritis; MRI – magnetic resonance imaging