For numbered affiliations see end of article.

Correspondence to: J W Busse
bussejw@mcmaster.ca

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RAPID RECOMMENDATIONS

Commonly used interventional procedures for non-cancer chronic spine pain: a clinical practice guideline

Jason W Busse, [1, 2, 3] Stéphane Genevay, [4] Arnav Agarwal, [2] Christopher J Standaert, [5] Kevin Carneiro, [6] Jason Friedrich, [7] Manuela Ferreira, [8] Hilde Verbeke, [9] Jens Ivar Brox, [10, 11] Hong Xiao, [12] Jasmeer Singh Virdee, [13] Janet Gunderson, [14] Gary Foster, [15] Conrad Heegsma, [15] Caroline F Samer, [16, 17] Matteo Coen, [18, 19] Gordon H Guyatt, [2] Xiaoqin Wang, [2] Behnam Sadeghirad, [2, 3] Faheem Malam, [20] Dena Zeraatkar, [2, 3] Per O Vandvik, [21] Ting Zhou, [22] Feng Xie, [2] Reed A C Siemieniuk, [2] Thomas Agoritsas[2, 18, 23]

ABSTRACT

CLINICAL QUESTION

What is the comparative effectiveness and safety of commonly used interventional procedures (such as spinal injections and ablation procedures) for chronic axial and radicular spine pain that is not associated with cancer or inflammatory arthropathy?

CURRENT PRACTICE

Chronic spine pain is a common, potentially disabling complaint, for which clinicians often administer interventional procedures. However, clinical practice guidelines provide inconsistent recommendations for their use.

RECOMMENDATIONS

For people living with chronic axial spine pain (≥3 months), the guideline panel issued strong recommendations against: joint radiofrequency ablation with or without joint targeted injection of local anaesthetic plus steroid; epidural injection of local anaesthetic, steroids, or their combination; joint-targeted injection of local anaesthetic, steroids, or their combination; and intramuscular injection of local anaesthetic with or without steroids. For people living with chronic radicular spine pain (≥3 months), the guideline panel issued strong recommendations against: dorsal root ganglion radiofrequency with or without epidural injection of local anaesthetic or local anaesthetic plus steroids; and epidural injection of local anaesthetic, steroids, or their combination.

HOW THIS GUIDELINE WAS CREATED

An international guideline development panel including four people living with chronic spine pain, 10 clinicians with experience managing chronic spine pain, and eight methodologists, produced these recommendations in adherence with standards for trustworthy guidelines using the GRADE approach. The MAGIC Evidence Ecosystem Foundation provided methodological support. The guideline panel applied an individual patient perspective when formulating recommendations.

THE EVIDENCE

These recommendations are informed by a linked systematic review and network meta-analysis of randomised trials and a systematic review of observational studies, summarising the current body of evidence for benefits and harms of common interventional procedures for axial and radicular, chronic, non-cancer spine pain. Specifically, injection of local anaesthetic, steroids, or their combination into the cervical or lumbar facet joint or sacroiliac joint; epidural injections of local anaesthetic, steroids, or their combination; radiofrequency of dorsal root ganglion; radiofrequency denervation of cervical or lumbar facet joints or the sacroiliac joint; and paravertebral intramuscular injections of local anaesthetic, steroids, or their combination.

UNDERSTANDING THE RECOMMENDATIONS

These recommendations apply to people living with chronic spine pain (≥3 months duration) that is not associated with cancer or inflammatory arthropathy and do not apply to the management of acute spine pain. Further research is warranted and may alter recommendations in the future: in particular, whether there are differences in treatment effects based on subtypes of chronic spine pain, establishing the effectiveness of interventional procedures currently supported by low or very low certainty evidence, and effects on poorly reported patient-important outcomes (such as opioid use, return to work, and sleep quality).

Introduction

Spine pain is defined as chronic when it persists for three months or longer and has resulted in pain on at least half of the days in the past six months.[1] Pain may be localised to the midline (axial) or referred distally (radicular) typically because of nerve root irritation (such as sciatica). Advanced imaging is often acquired for chronic spine pain, but incidental findings are common[2-4] and there is low correlation between pathology and symptoms.[5] Most chronic spine pain cannot be attributed to a specific cause, and approximately 85% of patients present with non-specific pain.[6-9]

The global prevalence of chronic low back pain has been estimated at 4% among adults aged 24-39 years and 20% among adults aged 20-59.[10] The prevalence among older adults is likely higher,[11] and chronic low back pain is the leading cause of disability worldwide.[12] Neck pain is another common type of chronic spinal pain, estimated as the third leading cause of years lived with disability.[13] In 2016, low back and neck pain accounted for the highest healthcare spending in the US at $134.5 billion, of which 9.2% was patients' out-of-pocket expenses.[14]

Current practice

Interventional procedures—including paravertebral intramuscular injections, epidural injections, nerve blocks, and nerve ablation procedures—are increasingly used to manage chronic spine pain, particularly in North America. These procedures are hypothesised to attenuate chronic pain by interrupting pain related nerve signals through reducing local inflammation (epidural steroids), numbing nerves (nerve blocks), or targeted destruction of nerves responsible for transmitting pain (radiofrequency ablation).

Between 1994 and 2001 in the US, there was a 271% increase in lumbar epidural steroid injections (from 553 to 2055 per 100 000 patients) and a 231% increase in facet injections (from 80to 264 per 100 000 patients) for low back pain.[15] Facet joint or sacroiliac joint interventions in US Medicare recipients increased from approximately 425 000 in 2000 to 2.2 million interventions in 2013.[16] From 2007 to 2016, data from a national US insurer showed a 131% increase in the use of lumbar radiofrequency procedures (from 49 to 113 per 100 000 patients).[17] The number of US Medicare providers administering steroid injections along the spine increased 13% from 2012 to 2016.[18]

Despite rapid growth in use of interventional procedures for chronic spine pain, the supporting evidence is uncertain. An analysis of 17 review articles on epidural steroid injections for spine pain found inconsistent conclusions, and that positive results were three times more likely when the review was authored by an interventionalist (9 of 10 positive; 90%) versus a non-interventionalist (2 of 7 positive; 29%).[19] The study authors suggested several explanations, including confirmation bias and secondary gain, as interventional procedures for chronic pain are often well reimbursed. For example, in 2017-18, the average billings among 106 physicians working at pain clinics providing nerve blocks in Ontario, Canada, was C$724 183/year (£405 905/year).[20] Concurrently, a 2016/2017 survey of 777 Canadian physicians who performed interventional procedures for chronic spine pain found that only 37% believed their colleagues practiced in accordance with the current best evidence.[21] Further, there is large variability among providers, with the top 10% of interventionalists in the US performing nine times more procedures per patient compared with the bottom 10%.[22]

Why is the guideline needed?

A 2023 synthesis of 21 clinical practice guidelines on interventional procedures for low back pain concluded: "there was no consistency in recommendations for or against any interventional procedure, even after accounting for the quality of the [clinical practice guideline]"[23] (see table 1 for examples). One contributing factor is that several clinical practice guidelines for interventional procedures are characterised as consensus based.[28-33] Such guidelines are more likely to produce recommendations that violate the principles of evidence based medicine than guidelines characterised as evidence based.[34] Moreover, guidelines for interventional procedures and chronic spine pain rarely involve patient partners, fail to consider patients' values and preferences, and typically do not describe an explicit process to evaluate the overall certainty of evidence.[35]

Table 1 | Examples of current guidance for interventional procedures and chronic spine pain

Recent guidelines	Recommendations
2022 American Society of Pain and Neuroscience (ASPN) Evidence-Based Clinical Guideline of Interventional Treatments for Low Back Pain[24]	• Strong recommendation in favour of epidural injections (interlaminar, transforaminal, or caudal) of local anaesthetic, steroids, or their combination, for chronic low back pain due to disc disease, spinal stenosis, or post-surgical syndrome • Strong recommendation in favour of trigger point injections, irrespective of the type of medication, for chronic back pain • Strong recommendation in favour of sacroiliac joint injection for short term relief from sacroiliac joint dysfunction • Strong recommendation in favour of conventional or cooled lumbar radiofrequency ablation for low back pain • Strong recommendation in favour of sacroiliac joint denervation/ablation for sacroiliac joint dysfunction pain • Strong recommendation for basivertebral nerve ablation for chronic back pain
2021 American College of Occupational and Environmental Medicine Low Back Disorders Guideline[25]	• Recommended against lumbar epidural injections for spinal stenosis (moderate confidence) or chronic low back pain in the absence of significant radicular symptoms (high confidence) • Trigger point injections of local anaesthetic may be recommended for chronic low back pain that is not resolving with exercise or NSAIDs (low confidence). Glucocorticosteroids are not recommended for use in trigger point injections (moderate confidence) • Therapeutic facet block injections are not recommended for chronic low back pain (low confidence) or any radicular pain syndrome (moderate confidence) • Radiofrequency neurotomy, neurotomy, or facet rhizotomy are not recommended for treatment of chronic low back pain, including that confirmed with diagnostic blocks (low confidence) • Dorsal root ganglia radiofrequency lesioning is not recommended for chronic sciatica (moderate certainty)
2021 Epidural interventions in the management of chronic spinal pain: American society of interventional pain physicians (ASIPP) comprehensive evidence-based guidelines[26]	• Recommended in favour of fluoroscopically guided epidural injections, with or without steroids, for caudal epidural injections, lumbar interlaminar epidural injections, lumbar transforaminal epidural injections, and cervical interlaminar epidural injections for chronic spine pain associated with: - Disc herniation (strong recommendation) - Spinal stenosis (moderate to strong recommendation) - Axial discogenic pain (moderate to strong recommendation) - Post-surgery syndrome (moderate to strong recommendation)
2020 NICE Guideline on Low back pain and sciatica in over 16s: assessment and management[27]	• Do not offer spinal injections for managing low back pain • Only perform radiofrequency denervation for chronic low back pain after a positive response to a medial branch block

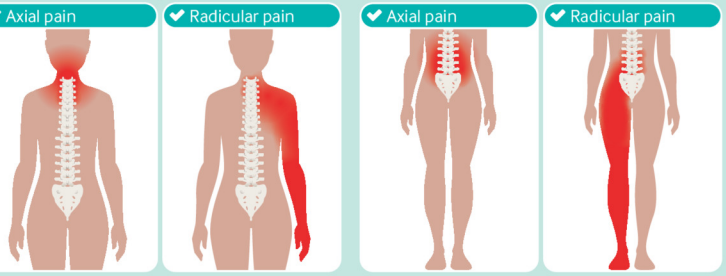
Visual summary of recommendation

Population

This recommendation applies only to people with these characteristics:

- ✔ Adults with chronic spine pain (≥3 months duration)

Cervical spinal level		Lumbar or sacroiliac spinal level	
✔ Axial pain	✔ Radicular pain	✔ Axial pain	✔ Radicular pain



Does NOT apply to:

- ✖ Acute spine pain (<3 months duration)
- ✖ Chronic spine pain secondary to (cancer, inflammatory arthropathy)

Strong recommendations AGAINST

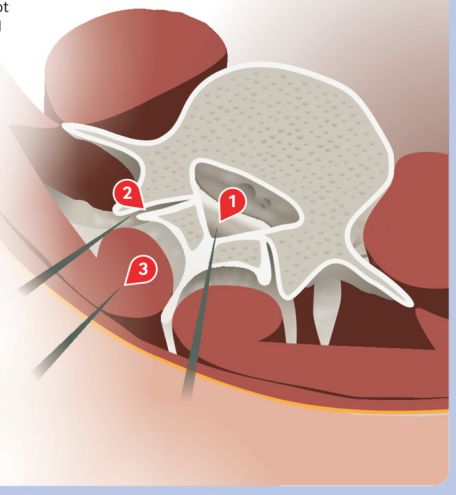
All or nearly all well-informed people would likely not want such interventions. Such interventions should therefore not be offered outside of a clinical trial

Chronic axial spine pain

- ✖ Epidural injection of local anaesthetic, steroids, or their combination (1)
- ✖ Joint radiofrequency ablation with or without joint targeted injection of local anaesthetic and steroids (2)
- ✖ Joint-targeted injection of local anaesthetic, steroids, or their combination (2)
- ✖ Intramuscular injection of local anaesthetic with or without steroids (3)

Chronic radicular spine pain

- ✖ Dorsal root ganglion radiofrequency with or without epidural injection of local anaesthetic, or local anaesthetic and steroids
- ✖ Epidural injection of local anaesthetic, steroids, or their combination (1)



Additional areas of uncertainty

Subgroup effects

There may be differential effects of interventional procedures based on subtypes of chronic spine pain

Research needed

Chronic axial spine pain:

- effectiveness of joint radiofrequency ablation
- intramuscular injection of local anaesthetic with or without steroids
- joint-targeted injection of local anaesthetic with or without steroids

Evidence required

How interventions affect other patient-important outcomes that are poorly reported among existing trials:

- role functioning (including return to work)
- social functioning
- mental functioning
- sleep quality
- opioid use
- adverse events

A detailed summary of benefits and harms associated with interventional procedures is available in the linked systematic review and network meta-analysis

https://bit.ly/bmj-spine

Practical issues

Cost and access

- Expense may be a barrier to accessing procedures unless patients have public or private coverage
- Patients must travel to a clinic or hospital that administers interventional procedures and, if perceived effective, return approximately every 2 weeks to 3 months for injections and approximately every 6 months for nerve ablation procedures

Adverse effects

- Interventional procedures may be associated with a small risk of moderate to serious harms, such as deep infection, and temporary altered level of consciousness
- Interventional procedures may be associated with a very small risk of catastrophic harms, such as paralysis and death following epidural steroid injection

Values and preferences

Chronic spine pain

Most adults living with chronic spine pain place high value on small but important pain relief

Acceptable risks - interventional procedures

Patients would be willing to accept the typical risks and burden associated with interventional procedures for an improvement in pain approximating the minimally important difference of 1.5 cm on a 10 cm visual analogue scale

Unacceptable risks

Patients would be disinclined to receive treatment with an interventional procedure for which there is very low certainty of evidence for benefit or low certainty of evidence for no benefit, and moderate to high certainty evidence of risk of harm and/or burden

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MAGIC app

Given the lack of trustworthy guidelines in this area of high unmet clinical need, the Rapid Recommendations team identified that a careful appraisal of the full body of evidence would produce guidance that, if followed, would optimise the concordance between evidence and clinical use of interventional procedures for chronic spine pain.

The population considered for our guideline was adult patients living with chronic axial and/or radicular spine pain that was not associated with cancer, infection, or inflammatory spondylarthritis. Eligible procedures included joint-targeted injections (injection of local anaesthetic, steroids, or their combination into the cervical or lumbar facet joint, or sacroiliac joint); epidural injections of local

anaesthetic, steroids, or their combination; radiofrequency of dorsal root ganglion; radiofrequency denervation of cervical or lumbar facet joints, or the sacroiliac joint; and paravertebral intramuscular injections of local anaesthetic, steroids, or their combination. The panel's recommendations were informed by linked systematic reviews (box 1). The infographic provides the recommendations together with an overview of the absolute benefits and harms of common interventional procedures for chronic spine pain in the standard GRADE format.

Box 1: Linked articles in this *BMJ* Rapid Recommendations cluster

- Busse JW, Genevay S, Agarwal A, et al. Commonly used interventional procedures for non-cancer chronic spine pain: a clinical practice guideline. *BMJ* 2025;388:e079970, doi:10.1136/bmj-2024-079970
  - Summary of results from the Rapid Recommendation process
- Wang X, Martin G, Sadeghirad B, et al. Common interventional procedures for chronic non-cancer spine pain: a systematic review and network meta-analysis of randomised trials. *BMJ* 2025;388:e079971, doi:10.1136/bmj-2024-079971
- Malam F, Asif MS, Khalid MF, et al. Adverse events associated with common interventional procedures for chronic spine pain: a systematic review and meta-analysis of non-randomized studies. *BMJ Open* (submitted)
- MAGICapp (https://app.magicapp.org/#/guideline/nBRK8n) multi-layered version of recommendations, rationale, and evidence summaries for use on all electronic devices

Patient and public involvement

Four people living with chronic spine pain, who were full members of the guideline panel, contributed to the selection and prioritisation of outcomes, values and preferences assessments, critical feedback to the protocol, and interpretation of findings for the *BMJ* Rapid Recommendation and the associated systematic reviews.

How the recommendations were created

Our international panel—including physiatrists (also called physical medicine and rehabilitation physicians), anaesthesiologists, rheumatologists, a physiotherapist, general internists, a clinical pharmacologist, epidemiologists, methodologists, and people living with chronic spine pain—decided the scope of recommendations and the outcomes that are most important to patients. Six of our clinical experts had experience administering interventional procedures for chronic spine pain. Our patient partners reported a range of experiences regarding interventional procedures. Three had received various interventional procedures for their chronic pain, with two reporting relief and one who did not. The fourth lived with chronic spine pain but had no personal experience with interventional procedures. After parallel teams completed a systematic review and network meta-analysis of randomised controlled trials on the benefits and harms of common interventional procedures for chronic spine pain, and a systematic review of observational studies exploring harms associated with interventional procedures, the panel met online four times to discuss the evidence and formulate recommendations. No panel member had financial conflicts of interest, and none declared any strong opinions for or against interventional procedures for chronic spine pain; intellectual and professional conflicts were minimised as per Rapid Recommendations usual methodology, by balancing them in the composition of the panel, and by having both a clinical and methods co-chair who were free of any conflicts of interest lead panel deliberations (appendix 1 on bmj.com).

The panel followed the *BMJ* Rapid Recommendations approach for creating trustworthy guidance,[67] including use of GRADE to critically appraise the evidence and create recommendations.[68] The panel considered the balance of benefits, harms, and burdens of each intervention, the certainty of the evidence for each outcome, typical and expected variations in patient values and preferences, and practical issues related to use, acceptability, feasibility, and equity.[69]

Recommendations can be strong or conditional, and for or against a course of action. Strong recommendations typically require a clear imbalance between benefits and harms or burdens supported by high or moderate certainty evidence; however, there are five paradigmatic scenarios in which a strong recommendation can be made based on low certainty evidence.[69] One such scenario is when there is low certainty of benefit (or lack of benefit) and moderate to high certainty of greater risk of important harm or burden.

We required 80% consensus among panel members for strong recommendations and a majority consensus for conditional recommendations. Two experienced guideline methodologists (JWB and TA) oversaw the consensus process. The evidence synthesis teams prepared draft summary of findings tables before the panel meetings, following GRADE guidance, from the accompanying network meta-analysis[36] and systematic review of observational studies.[44]

The evidence

The linked systematic review and network-meta-analysis included 132 randomised trials, of which 81 trials with 7977 participants were included in meta-analyses.[36] These trials reported on 13 categories of interventional procedures compared with usual care or sham procedures in patients with axial or radicular chronic spine pain (box 2). Table 2 and supplementary table 1 (appendix 2) on bmj.com provide an overview of the numbers and types of patients included, study funding, subtypes of chronic spine pain, and whether a positive diagnostic block was an eligibility criterion. Our panel selected eight patient-important outcomes: (1) pain relief, (2) physical functioning, (3) emotional functioning, (4) role functioning, including return to work, (5) social functioning, (6) sleep quality, (7) opioid use, and (8) adverse events. Our selection process was guided by the Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials (IMMPACT).[39 40] The panel designated pain relief as our critical outcome. This is supported by a discrete choice experiment involving 211 adults living with chronic low back pain, which found that patients are most concerned with pain relief, followed by duration of pain relief.[41]

Box 2: Categories of interventional procedures administered for chronic spine pain that were considered in the *BMJ* Rapid Recommendations review

- Epidural injection of local anaesthetic
- Epidural steroid injection
- Epidural injection of local anaesthetic and steroids
- Joint-targeted injection of local anaesthetic
- Joint-targeted steroid injection
- Joint-targeted injection of local anaesthetic and steroids
- Intramuscular injection of local anaesthetic
- Intramuscular injection of local anaesthetic and steroids
- Dorsal root ganglion radiofrequency
- Dorsal root ganglion radiofrequency with epidural injection of local anaesthetic
- Dorsal root ganglion radiofrequency with epidural injection of local anaesthetic with steroids
- Joint radiofrequency nerve ablation
- Joint radiofrequency nerve ablation with joint-targeted injection of local anaesthetic and steroids

Table 2 | Characteristics from 81 eligible randomised clinical trials (7977 patients) included in a linked meta-analysis

Characteristic	Median (interquartile range) of means across trials unless stated otherwise
No of patients enrolled	64 (45-110)*
Age (mean years at baseline)	48 (44-56)
Sex (% women)	59% (50-67)†
Baseline pain (on 10 cm visual analogue scale for pain)	6.8 (5.9-7.7)‡
Presenting complaint§	• Chronic axial spine pain (n=45): facet joint syndrome (n=28; 35%), sacroiliac joint syndrome (n=9; 11%), intervertebral disc syndrome (n=3; 4%), not reported (n=2; 2%), spondylolisthesis (n=1; 1%), chronic post-surgical pain (n=1; 1%), mixed complaints (n=1; 1%) • Chronic radicular spine pain (n=34): disc herniation/bulge (n=24; 30%), spinal stenosis (n=8; 10%), chronic post-surgical pain (n=1; 1%), mixed complaints (n=1; 1%) • Mixed chronic axial and radicular spine pain (n=2; 3%)
Pain duration	• 62% of trials (n=50) reported duration of chronic pain: median duration 46 months (IQR 17-98) • 25% of trials (n=20) reported that pain was "chronic" or enrolled patients with chronic conditions, without other details • 13% of trials (n=11) enrolled ≥80% of patients with pain duration of ≥3 months
Positive diagnostic block required for enrolment¶	• Yes (n=32): >50% relief (n=13; 16%), >75% relief (n=5; 6%), >80% relief (n=6; 7%), unclear threshold for relief (n=6; 7%), used a positive block as an exclusion criterion (n=2; 3%) • No or not reported (n=49; 60%)
Trial location	North America (n=26; 32%), Europe (n=25; 31%), Asia (n=23; 28%), Africa (n=4; 5%), South America (n=2; 2%), Australia (n=1; 1%)
Funding	Not reported (n=33; 41%), unfunded (n=25; 31%), non-industry funding (n=22; 27%), industry funded (n=1; 1%)

Additional details are available in the network meta-analysis.[36]

* Total number of enrolled patients using study-level data.

† Proportion among eligible trials reporting this information (n=75).

‡ 81 trials reported baseline pain of patients.

§ As reported by trial authors.

¶ Diagnostic blocks (an injection of local anaesthetic to confirm the correct targeting of the nerve) carry a false positive rate of up to 60%.3738

Values and preferences

We surveyed our guideline panel, including the four patient partners, using an established framework[42 43] to inform the perceived values and preferences of a typical person living with chronic spine pain on potential benefits as well as harms and burdens of interventional procedures. We conducted our survey before presenting the panel with the results of our evidence syntheses informing benefits and harms of interventional procedures for chronic spine pain.[36 44] This exercise was informed by prior systematic reviews that found people living with chronic pain typically place high value on the possibility of small but important pain relief.[45 46] Our panel survey revealed that most people living with chronic spine pain would be inclined to receive an interventional procedure, even with moderate to high certainty evidence of harms or burden, if there was moderate or high certainty evidence of important benefit.

Alternately, our panel advised that, when presented with an interventional procedure of uncertain effectiveness (very low certainty evidence), and for which there is moderate to high certainty evidence of increased risk of harm or burden, almost all people living with chronic spine pain would be disinclined to receive treatment. Further, the panel inferred that almost all people living with chronic spine pain, when presented with an interventional procedure for which the point estimate suggests no benefit, but the evidence is low certainty, and where there is moderate to high evidence of increased risk of harm or burden, would be disinclined to receive treatment. Finally, in the presence of low certainty evidence of benefit for an interventional procedure, and moderate to high evidence of harm or burden, a minority (<50%) of people living with chronic spine pain would be interested in receiving treatment.

Following our panel meeting to establish patients' values and preferences, a discrete choice experiment was published that involved 424 individuals with chronic low back pain.[47] The investigators assessed participants' preferences towards non-surgical treatment options for chronic back pain, including mind-body interventions, supervised physical activation, physical manipulations, self management courses, physiotherapy, and corticosteroid injections. They found corticosteroid injections were rejected by the large majority and that participants were most likely to have concerns about receiving corticosteroid injections versus other non-surgical options for their chronic low back pain.

Understanding the recommendations

The panel reviewed the evidence for benefits and harms among the 13 selected interventional procedures or combinations of procedures for chronic spine pain (box 2).[36 44] There was no high certainty evidence of important pain relief (or benefit on any other effectiveness outcome) for any intervention for either chronic axial spine pain or chronic radicular spine pain. All interventional procedures supported by moderate or low certainty evidence showed little to no pain relief compared with sham procedures (see infographic).

We found no evidence of subgroup effects based on clinical condition.[36] Further, since all pooled effects in our network meta-analysis supported by low or moderate certainty evidence showed little to no effect on pain relief relative to sham procedures, then if an interventional procedure was effective in certain subtypes

of axial or radicular pain it must increase pain in other subtypes; we judged this was unlikely.

Low certainty evidence supported a 0.7% incidence of deep infection (after joint radiofrequency nerve ablation, joint targeted steroid injection, and epidural injection of local anaesthetic and steroids), a 1.4% incidence of dural puncture (after epidural steroid injection, joint radiofrequency nerve ablation, and joint-targeted injection of local anaesthetic and steroids), an 8.6% incidence of prolonged (>48 hours) pain or stiffness (after joint radiofrequency nerve ablation with or without joint targeted injection of steroids, and dorsal root ganglion radiofrequency) and a 2.1% incidence of temporary altered level of consciousness (after joint targeted steroid injection, and epidural steroid injection).[44] The panel was also aware of very rare but catastrophic complications of interventional procedures for spine pain not captured in our evidence syntheses, such as paraplegia after epidural injection.[48-50] The panel had high certainty that undergoing interventional procedures for chronic spine pain was associated with important burden (such as travel, discomfort, productivity loss), which would be recurring as these interventions are typically repeated on a regular basis, and that some patients would bear substantial out-of-pocket costs.

The panel concluded that all or almost all informed patients would choose to avoid interventional procedures for axial or radicular chronic spine pain because all low and moderate certainty evidence suggests little to no benefit on pain relief compared with sham procedures, and these procedures are burdensome and may result in adverse events.[51 52] The panel acknowledged that the evidence for some interventional procedures was only low or very low certainty and agreed it would be appropriate to provide them in a research setting.

To whom do the recommendations apply?

The recommendations apply to adults living with moderate to severe chronic, axial or radicular, spine pain (that is, neck, back, sacroiliac) lasting three months or longer in duration. They do not apply to the management of acute spine pain (<3 months duration), or chronic spine pain associated with cancer or inflammatory arthropathy.

Absolute benefits and harms

The infographic explains the recommendations and provides links to MAGICapp with evidence summaries of absolute benefits and harms of interventional procedures for chronic spine pain. Estimates of baseline risk for effects come from the control arms of eligible trials from the associated network meta-analysis.[36] Only approximately half of randomised trials eligible for our network meta-analysis reported adverse events, and this evidence, as well as the results from our systematic review of observational studies on harms from interventional procedures,[44] proved only low or very low certainty.

The clinical experts on our panel considered findings from our evidence syntheses regarding the potential harms associated with interventional procedures, as well as published reports on very rare but severe harms. The resulting consensus was that interventional procedures for chronic spine pain were costly and may be associated with a small risk of moderate harms (for example, an 8.6% risk of prolonged (>48 hours) pain or stiffness, 2.1% risk of temporary altered level of consciousness, 1.4% risk of dural puncture, 0.7% risk of deep infection),[44 53] and a very small risk of catastrophic harms (such as infection resulting in meningitis, spinal cord injury, and paraplegia).[54-58] We were unable to quantify the risks of catastrophic harms as they were reported in case studies or databases that did not specify a denominator. For example, between 1997 and 2014, a total of 90 serious adverse events that occurred within minutes to 48 hours after epidural injections of corticosteroids for management of neck and back pain were captured by the US Food and Drug Administration (FDA) Adverse Event Reporting System database. These included death, spinal cord infarction, paraplegia, quadriplegia, cortical blindness, stroke, seizures, and brain oedema.[59 60]

- The panel was confident of the following, relative to sham procedures:
  - Moderate certainty evidence showed that, for chronic axial spine pain, epidural injection of local anaesthetic (with or without steroids) and joint-targeted steroid injections probably have little to no effect on pain relief.[36]
  - Moderate certainty evidence showed that, for chronic radicular spine pain, epidural injection of local anaesthetic with steroids and dorsal root ganglion radiofrequency probably have little to no effect on pain relief.[36]
  - It is unlikely that new information will result in important changes in best estimates of effect for outcomes that are supported by moderate certainty evidence.
- The panel was less confident about:
  - For chronic axial spine pain, the effect of intramuscular injection of local anaesthetic (with or without steroids), epidural injection of steroids, and joint-targeted injection of local anaesthetic (with or without steroids) on pain relief. Although effects showed little to no difference in pain relief (except for intramuscular injection of local anaesthetic and steroids, which showed increased pain) versus sham procedures, the evidence was only low certainty. We considered that a beneficial effect of epidural injection of steroids is unlikely because there is moderate certainty evidence that an epidural injection with steroids and local anaesthetic probably has little to no effect on pain. The effect of joint radiofrequency was supported by only very low certainty evidence due to small study effects and risk of bias. Four trials with unblinded providers reported larger effects on pain relief than did seven trials with blinded providers (−1.74 cm on a 10 cm visual analogue scale for pain relief (95% confidence interval −2.73 to −0.76) for unblinded trials versus −0.23 cm (−0.60 to 0.14) for blinded trials; test of interaction P value 0.005).[36]
  - For chronic radicular spine pain, epidural injection of local anaesthetic or steroids showed little to no difference in pain relief, but the evidence was only low certainty. However, the effect of epidural injection of either local anaesthetic or steroids in isolation is unlikely as we found moderate evidence that the combination is probably not effective.[36]
  - Harms associated with interventional procedures for chronic spine pain, which were supported by very low to low certainty evidence.[36 44]

Practical issues and other considerations

Box 3 outlines the key practical issues for patients and clinicians regarding interventional procedures for chronic spine pain. Interventional procedures are associated with burden to patients, who must travel to a healthcare provider. They are not curative and, if they have any effect at all, intramuscular, joint-targeted, or epidural injections are typically repeated approximately every 2

weeks to 3 months. Nerve ablation procedures, if they have any effect at all, are typically repeated approximately every 6 months.

Box 3: Practical issues

Cost and access

- Expense may be a barrier to accessing interventional procedures unless patients reside in a country in which the government covers the cost, or they have private coverage
- Patients must travel to a clinic or hospital that administers the interventional procedure and, if the procedure is perceived to be effective, return approximately every 2 weeks to 3 months for injections or approximately every 6 months for nerve ablation procedures

Adverse effects

- Interventional procedures may be associated with a small risk of moderate harms, such as temporary altered level of consciousness, deep infection, and prolonged pain and stiffness
- Interventional procedures may be associated with a very small risk of catastrophic harms, including paralysis and death

In some jurisdictions, patients will bear the costs of interventional procedures, which may be substantial. In the US, the average cost for a single epidural steroid injection is more than US$1000, and can be as high as US$5000, and the average cost for radiofrequency ablation is approximately US$6,000.[18 61-63] Considering a middle-income country, such as China, the cost of interventional procedures for chronic spine pain ranges from US$3 to US$538. We have provided a detailed breakdown of costs in China for interventional spine procedures in supplementary tables 2 and 3 (appendix 2). Despite our finding that current evidence suggests common interventional procedures are no more effective than sham procedures for chronic spine pain, the substantial reimbursement associated with these procedures may act as a perverse incentive for their delivery as opposed to less well paying, and more time-consuming, interventions that have evidence of effectiveness (for example, cognitive functional therapy,[64] exercise therapy,[65] pain reprocessing therapy[66]).

Costs and resources

When formulating recommendations, the panel focused on patients' perspectives rather than that of society. However, both availability and costs of interventional procedures for chronic spine pain are likely to influence decision making.

Uncertainties for future research

- Key research questions to inform decision makers and future guidelines include:
  - Are there systematic differences in treatment effects of interventional procedures based on subtypes of chronic spine pain? Our network meta-analysis found no credible subgroup effects, but we were unable to explore all clinical conditions due to limited evidence for some types of pain.[36]
  - What are the effects on pain relief for interventional procedures currently informed by low or very low certainty evidence? Specifically, joint radiofrequency, intramuscular injection of local anaesthetic (with or without steroids), and joint-targeted injection of local anaesthetic (with or without steroids) for chronic axial pain.
  - What are the effects of interventional procedures for chronic spine pain on patient-important outcomes that were poorly reported among trials that informed our evidence synthesis? Specifically, role functioning (including return to work), social functioning, mental functioning, sleep quality, opioid use, and adverse events.

How patients were involved in the creation of this article:

Four people living with chronic spine pain, including two military veterans, were full panel members. These panel members identified important outcomes, informed the discussion on values and preferences and voted on all recommendations. They participated in online meetings and email discussions and met all authorship criteria.

Education in practice

- How do you currently approach the management of people living with chronic spine pain that is not associated with cancer or inflammatory arthropathy?
- How can this article help you explain the evidence to patients considering common interventional procedures for their chronic spine pain?

AUTHOR AFFILIATIONS

1 Michael G. DeGroote National Pain Centre, McMaster University, Hamilton, ON, Canada
2 Department of Health Research Methods, Evidence, and Impact, McMaster University, Hamilton, Ontario, Canada
3 Department of Anesthesia, McMaster University, Hamilton, ON, Canada
4 Division of Rheumatology, Department of Medicine, Geneva University Hospitals, Geneva, Switzerland
5 Department of Physical Medicine and Rehabilitation, University of Pittsburgh School of Medicine, Pittsburgh, PA, USA
6 Department of Neurosurgery, University of North Carolina at Chapel Hill, Chapel Hill, NC, USA
7 Department of Physical Medicine and Rehabilitation, University of Colorado School of Medicine, Aurora, CO, USA
8 The University of Sydney, Sydney Musculoskeletal Health and the Kolling Institute, School of Health Sciences, Faculty of Medicine and Health, St Leonards, NSW 2064, Australia
9 Leuven Center for Algology and Pain Management, University Hospitals Leuven, Leuven, Belgium
10 Department of Physical Medicine and Rehabilitation, Oslo University Hospital Ullevaal, Oslo, Norway
11 Institute of Clinical Medicine, Medical Faculty, Oslo University, Oslo, Norway
12 Department of Pain Management, West China Hospital, Sichuan University, Chengdu, Sichuan, China
13 International Trade Centre, Palais des Nations, Geneva, Switzerland
14 Chronic Pain Network, McMaster University, Hamilton, Ontario, Canada
15 The Canadian Veterans Chronic Pain Centre of Excellence, Hamilton, ON, Canada
16 Division of Clinical Pharmacology and Toxicology, Geneva University Hospitals
17 Faculty of Medicine, University of Geneva, Switzerland
18 Division of General Internal Medicine, Department of Medicine, University Hospitals of Geneva, University of Geneva, Switzerland

[19] Unit of Development and Research in Medical Education, Faculty of Medicine, University of Geneva, Geneva, Switzerland

[20] Michael G. DeGroote School of Medicine, McMaster University, Hamilton, ON, Canada

[21] Department of Medicine, Innlandet Hospital Trust, Gjøvik, Norway

[22] School of International Pharmaceutical Business, China Pharmaceutical University, Nanjing, China

[23] The MAGIC Evidence Ecosystem Foundation, Oslo, Norway

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Transparency: JWB affirms that the manuscript is an honest, accurate, and transparent account of the recommendations being reported; that no important aspects of the recommendations have been omitted; and that any discrepancies from the recommendations as planned (and, if relevant, registered) have been explained.

This *BMJ Rapid Recommendation* article is one of a series that provides clinicians with trustworthy recommendations for potentially practice changing evidence. *BMJ* Rapid Recommendations represent a collaborative effort between the MAGIC group (www.magicevidence.org) and *The BMJ*. A summary is offered here, and the full version is on the MAGICapp (www.magicapp.org) for all devices in multilayered formats. We encourage adaptation and contextualisation of our recommendations to local or other contexts. Those considering use or adaptation of content may go to MAGICapp to link or extract its content, or contact *The BMJ* for permission to reuse content in this article.

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Appendix 1: Full list of authors' declarations of interests

Appendix 2: Supplementary tables 1-3

PDF of infographic