



## Topic Brief: Cervical Degenerative Disease

**Date:** 7/22/2021

**Nomination Number:** 0955

**Purpose:** This document summarizes the information addressing a nomination submitted on June 11, 2021 through the Effective Health Care Website. This information was used to inform the Evidence-based Practice Center (EPC) Program decisions about whether to produce an evidence report on the topic, and if so, what type of evidence report would be most suitable.

**Issue:** Cervical degenerative disease is a form of osteoarthritis associated with nerve, neck, shoulder, and arm pain. Rarely, these arthritic changes can cause muscle weakness in the upper extremities or lower extremities if the spinal cord is injured. Cervical degenerative disease is associated with older age and is estimated to occur in 27 percent of the Medicare population annually. Due to the potential risks of surgery, it is important to offer evidence-based treatments to improve outcomes and balance the risks of treatment. The current guidelines for management of cervical degenerative disease were published in 2009. New evidence has been published since that time, and a new systematic review would inform the development of an updated guideline to inform practice for this painful, burdensome condition.

[Link to nomination](#)

### Recommendation

- Systematic review
- Technical brief
- Evidence map
- Rapid review
- Rapid response
- Expanded topic brief

### Key Findings

- We did not find any recent high quality existing systematic reviews that would negate the need for a new systematic review.
- We found a sufficient number of primary studies to warrant a new systematic review. Specifically, we found adequate studies addressing key questions (KQs) 2, 3b, 5, and 5a.
- The majority of the qualifying studies addressed KQ5, arthroplasty vs. anterior cervical discectomy and fusion, and device types used in anterior cervical discectomy.
- For the remaining KQs, we found no or few qualifying primary studies.

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### Background

Cervical degenerative disease results from the dehydration or desiccation of spinal disc material, reducing the flexibility and height of the disc. The prevalence of cervical degeneration increases with age and is expected to increase as the proportion of the population over the age of 60

increases. About 27 percent of the Medicare population is diagnosed with the condition annually.<sup>1</sup> The condition can be associated with pain, and treatment in the U.S. consists of medication and/or surgery. Surgical management is more prevalent with increasing age.<sup>2</sup>

The most recent guidelines on the surgical management of cervical degenerative disease from the Congress of Neurological Surgeons were published in 2009.<sup>3</sup> New evidence has been published since that time, warranting a new systematic review that could inform the development of an updated guideline to inform practice.

## **Nomination Summary**

The original topic nomination contained 11 questions: three prognosis questions, four surgical intervention questions, and four questions about adjacent segment disease and pseudarthrosis. In collaboration with the nominator, we consolidated the nomination into seven KQs pertaining to surgical interventions, including prognosis and monitoring, and comparative effectiveness of surgical interventions.

## **Scope**

1. What is the comparative effectiveness of surgical treatment compared to non-operative treatment on neurologic outcomes in patients with cervical degenerative conditions with mild or no cervical spondylotic myelopathy?
  - a. How does the effectiveness of surgery vary by myelopathy severity at the time of surgery?
2. What is the prognostic utility of preoperative magnetic resonance imaging (MRI) findings for neurologic recovery after surgery in patients with cervical spondylotic myelopathy?
3. In patients with cervical degenerative disease, what are the comparative effectiveness and harms of:
  - a. Anterior compared to posterior surgery
    - i. In patients with cervical radiculopathy?
    - ii. In patients with  $\geq 3$  levels of disease?
  - b. What are the comparative effectiveness and harms of cervical laminectomy and fusion compared to cervical laminoplasty in patients with cervical spondylotic myelopathy?
4. What are the effectiveness and harms of intraoperative neuromonitoring (e.g., with somatosensory or motor evoked potential measurements) on clinical outcomes in patients undergoing surgery for cervical spondylotic myelopathy?
5. What are the comparative effectiveness and harms of cervical arthroplasty compared to anterior cervical discectomy and fusion in patients with cervical spondylotic radiculopathy or myelopathy at 1 or 2 levels?
  - a. In patients undergoing anterior cervical discectomy, how do outcomes vary with choice of interbody graft or device type?
6. In patients with pseudarthrosis after prior anterior cervical fusion surgery, what are the comparative effectiveness and harms of posterior approaches compared to revision anterior arthrodesis?
7. What is the sensitivity and specificity of imaging assessment for identifying symptomatic pseudarthrosis after prior cervical fusion surgery?

**Table 1. KQs 1-4 PICOs (population, intervention, comparator, and outcome)**

<b>Questions</b>	<ol style="list-style-type: none"> <li>1. Surgical vs. non-operative treatment             <ol style="list-style-type: none"> <li>a. By myelopathy severity</li> </ol> </li> <li>2. MRI for prognosis</li> </ol>	<ol style="list-style-type: none"> <li>3. Comparative effectiveness and harms of:             <ol style="list-style-type: none"> <li>a. Anterior vs. posterior surgery                 <ol style="list-style-type: none"> <li>i. in cervical radiculopathy</li> <li>ii. in <math>\geq 3</math> levels of disease</li> </ol> </li> <li>b. Laminectomy and fusion vs. laminoplasty</li> </ol> </li> <li>4. Effectiveness and harms of intraoperative neuromonitoring</li> </ol>
<b>Population</b>	<p>Patients with cervical degenerative conditions who have mild or no cervical spondylotic myelopathy</p> <p>1a. Degree of myelopathy severity at the time of surgery</p>	<p>3ai. Patients with cervical radiculopathy of any level</p> <p>3aii. Patients with <math>\geq 3</math> levels of cervical degenerative disease</p> <p>3b and 4. Patients with cervical spondylotic myelopathy</p>
<b>Interventions</b>	<ol style="list-style-type: none"> <li>1. Surgery</li> </ol>	<p>3ai. and 3aii. Anterior surgery</p> <p>3b. Cervical laminectomy and fusion</p> <p>4. Intraoperative monitoring</p>
<b>Comparators</b>	<p>Non-operative treatments (e.g., immobilization, anti-inflammatory medications, physical therapy, cervical traction, epidural steroid injections, clinical observation)</p>	<p>3ai. and 3aii. Posterior surgery</p> <p>3b. Cervical laminoplasty</p> <p>4. No intraoperative monitoring</p>
<b>Outcomes</b>	<p>Neurologic outcomes (e.g., pain (VAS scores, NDI, SF-12, EQ-5D, PROMIS-29), sensory disturbance, weakness in the dermatomes and myotomes of the affected nerve root, mJOA score, Nurick scoring system, MDI, SF-36, quantitative gait analysis); QOL</p>	<p>Neurologic outcomes (e.g., pain (VAS scores, NDI, SF-12, EQ-5D, PROMIS-29), sensory disturbance, weakness in the dermatomes and myotomes of the affected nerve root, mJOA score, Nurick scoring system, MDI, SF-36, quantitative gait analysis); fusion rate; reoperation rate; QOL; harms (any)</p>

Abbreviations: EQ-5D=EuroQol-5 dimension instrument; KQ=key question; MDI=myelopathy disability index; MRI=magnetic resonance imaging; mJOA=modified Japanese orthopedic association scale; NDI=neck disability index; PROMIS-29=patient reported outcome measurement information system; QOL=quality of life; SF=short form health survey (12 or 36 items); VAS= visual analogue scale for pain.

**Table 2. KQs 5-7 PICOs (population, intervention, comparator, and outcome)**

<b>Questions</b>	<ol style="list-style-type: none"> <li>5. Arthroplasty vs. anterior cervical discectomy and fusion             <ol style="list-style-type: none"> <li>a. By interbody graft or device type</li> </ol> </li> </ol>	<ol style="list-style-type: none"> <li>6. Posterior approaches vs. revision anterior arthrodesis in pseudarthrosis</li> <li>7. Imaging for pseudarthrosis diagnosis</li> </ol>
<b>Population</b>	<p>Patients with cervical spondylotic radiculopathy or myelopathy at 1 or 2 levels</p>	<p>Patients with pseudarthrosis after prior anterior cervical fusion surgery</p>
<b>Interventions</b>	<p>Cervical arthroplasty</p>	<p>6. Posterior approaches for arthrodesis</p> <p>7. Imaging assessments (MRI ,CT, dynamic x-ray)</p>
<b>Comparators</b>	<p>Anterior discectomy and fusion</p>	<p>6. Revision anterior arthrodesis</p> <p>7. No imaging, other imaging type</p>
<b>Outcomes</b>	<p>Symptomatic adjacent segment disease, reoperation rates, radiologic fusion rates, QOL, harms (any)</p>	<p>6. Fusion rates, reoperation rate, QOL, harms (any) and/or fusion rates</p>

Abbreviations: CT=computed tomography; KQ=key question; MRI=magnetic resonance imaging.

## Assessment Methods

See Appendix A.

## Summary of Literature Findings

We did not find any recent, high quality systematic reviews that would negate the need for a new systematic review. Additionally, we found enough primary studies for a new systematic review addressing KQs 2, 3b, 5, and 5a. For the other KQs, we found no or few studies.

For KQ1, comparing surgical to non-operative treatment in patients with mild or no cervical spondylotic myelopathy, we reviewed a sample of 200 studies. We found no completed qualifying studies and two ongoing clinical trials.<sup>4,5</sup>

For KQ2, the prognostic utility of preoperative MRI findings for neurologic recovery after surgery in patients with cervical spondylotic myelopathy, we reviewed all studies found by our literature search, and found six prospective cohort studies,<sup>6-11</sup> four retrospective cohort studies,<sup>12-15</sup> and three in-process trials.<sup>16-18</sup>

For KQ3,

- We reviewed a sample of 200 studies.
- For KQ3ai, the comparative effectiveness and harms of anterior versus posterior surgery in patients with cervical radiculopathy, we found two qualifying studies.<sup>19,20</sup>
- In patients with  $\geq 3$  levels of disease (KQ3aii), we found only one qualifying study.<sup>21</sup>
- However, for KQ3b, the comparative effectiveness and harms of cervical laminectomy and fusion compared to cervical laminoplasty in patients with cervical spondylotic myelopathy, we found two randomized controlled trials,<sup>22,23</sup> two prospective cohort studies,<sup>24,25</sup> two retrospective cohort studies,<sup>26,27</sup> and one ongoing trial.<sup>28</sup>

For KQ4, the effectiveness and harms of intraoperative neuromonitoring (e.g., with somatosensory or motor evoked potential measurements) on clinical outcomes in patients undergoing surgery for cervical spondylotic myelopathy, we reviewed the entire search yield and did not find any qualifying studies.

For KQ5, the comparative effectiveness and harms of cervical arthroplasty compared to anterior cervical discectomy and fusion in patients with cervical spondylotic radiculopathy or myelopathy at 1 or 2 levels, we reviewed the entire search yield and found 11 randomized controlled trials (RCTs),<sup>29-39</sup> and eight prospective cohort studies.<sup>40-47</sup> For KQ5a, outcomes by interbody graft or device type in patients undergoing anterior cervical discectomy, we found 30 qualifying studies: 15 evaluating comparative effectiveness of devices/grfts,<sup>48-61</sup> 62 and 13 evaluating the effectiveness of devices/grfts.<sup>63-75</sup>

For KQ6, comparative effectiveness and harms of posterior approaches compared to revision anterior arthrodesis in patients with pseudarthrosis after prior anterior cervical fusion surgery, we reviewed the entire search yield and did not find any qualifying studies.

For KQ7, sensitivity and specificity of imaging assessment for identifying symptomatic pseudarthrosis after prior cervical fusion surgery, we reviewed the entire search yield and found one qualifying study.<sup>76</sup>

**Table 3.** Literature identified for each KQ

Question	Systematic reviews (8/2018-8/2021)	Primary studies (8/2016-8/2021)
KQ 1: Surgical vs. non-operative treatment	Total: 0	Total: 2 (from sample of 200 studies) Clinicaltrials.gov • Recruiting: 2
KQ 2: MRI for prognosis	Total: 0	Total: 13 • Retrospective cohort: 4 • Prospective cohort: 6  Clinicaltrials.gov • Recruiting: 3
KQ 3: Comparative effectiveness and harms of: a. Anterior vs. posterior surgery ai. in cervical radiculopathy aii. in $\geq 3$ levels of disease b. Laminectomy and fusion vs. laminoplasty	Total: 0	Total: 10 (from sample of 200 studies) • RCT: 2 • Retrospective cohort: 5 • Prospective cohort: 2  Clinicaltrials.gov Recruiting: 1
KQ 4: Effectiveness and harms of intraoperative neuromonitoring	Total: 0	Total: 0
KQ 5: Arthroplasty vs. anterior cervical discectomy and fusion a. By interbody graft or device type	Total: 0	Total: 48  RCT: 11 Retrospective cohort: 13 Prospective cohort: 20  Clinicaltrials.gov Recruiting: 4
KQ 6: Posterior approaches vs. revision anterior arthrodesis in pseudarthrosis	Total: 0	Total: 0
KQ 7: Imaging for pseudarthrosis diagnosis	Total: 0	Total: 1  Retrospective cohort: 1

Abbreviations: KQ=key question; MRI=magnetic resonance imaging; RCT=randomized controlled trial.

See Appendix B for detailed assessments of all EPC selection criteria.

## Summary of Selection Criteria Assessment

Cervical degenerative disease affects a significant proportion of a vulnerable population. The current guidelines are outdated, and a new systematic review would provide current evidence with which to update guidelines that could influence practice. We did not find recent duplicative high-quality systematic reviews, and we found a sufficient literature base for such a systematic review. Specifically, we found adequate studies to address KQs 2, 3b, 5, and 5a, and no or few studies addressing the remainder of the questions. The majority of the studies addressed KQ5, arthroplasty vs. anterior cervical discectomy and fusion, and device types used in anterior cervical discectomy. Therefore, we propose the development of a new systematic review, and estimate that it would be of medium size.

## Related Resources

We identified additional information during our assessment that might be useful to the nominating organization. Specifically, we found 13 systematic reviews that address KQs 1, 3ai, 3b, 5a, and 5, but these were not considered duplicative because they followed different methods for a systematic review than AHRQ systematic review methods, and because some had older and varied literature search dates, which would make it difficult for an end-user to incorporate into a single guideline. We present them here as resources relevant to the KQs that may be of interest.

KQ1:

- Does surgical treatment increase the progression of spinal cord injury in patients with ossification of posterior longitudinal ligament of cervical spine? A systematic review and meta-analysis<sup>77</sup>  
<https://dx.doi.org/10.1177/2309499020981782>

KQ3ai:

- Surgical Interventions for Cervical Radiculopathy without Myelopathy: A Systematic Review and Meta-Analysis<sup>78</sup>  
<https://doi.org/10.2106/JBJS.20.00324>
- Percutaneous endoscopic cervical foraminotomy as a new treatment for cervical radiculopathy: A systematic review and meta-analysis<sup>79</sup>  
<https://dx.doi.org/10.1097/MD.00000000000022744>
- Anterior cervical discectomy and fusion versus posterior cervical foraminotomy for the treatment of single-level unilateral cervical radiculopathy: a meta-analysis<sup>80</sup>  
<https://dx.doi.org/10.1186/s13018-020-01723-5>

KQ3b:

- Laminoplasty versus laminectomy with fusion for treatment of multilevel cervical compressive myelopathy: an updated meta-analysis<sup>81</sup>  
<https://doi.org/10.1136/postgradmedj-2020-139667>

KQ5:

- Comparison of cervical disc arthroplasty and anterior cervical discectomy and fusion for the treatment of cervical disc degenerative diseases on the basis of more than 60 months of follow-up: a systematic review and meta-analysis<sup>82</sup>

<https://dx.doi.org/10.1186/s12883-020-01717-0>

- Long-term Results Comparing Cervical Disc Arthroplasty to Anterior Cervical Discectomy and Fusion: A Systematic Review and Meta-Analysis of Randomized Controlled Trials<sup>83</sup>  
<https://dx.doi.org/10.1111/os.12585>
- Mid- to long-term rates of symptomatic adjacent-level disease requiring surgery after cervical total disc replacement compared with anterior cervical discectomy and fusion: a meta-analysis of prospective randomized clinical trials<sup>84</sup>  
<https://dx.doi.org/10.1186/s13018-020-01957-3>
- Efficacy and Safety of Total Disc Replacement compared with Anterior Cervical Discectomy and Fusion in the Treatment of Cervical Disease: A Meta-analysis<sup>85</sup>  
<https://dx.doi.org/10.1097/BRS.0000000000003569>
- Cervical disc arthroplasty versus anterior cervical discectomy and fusion: a meta-analysis of rates of adjacent-level surgery to 7-year follow-up<sup>86</sup>  
<https://dx.doi.org/10.21037/jss.2019.12.09>

KQ5a:

- Locking stand-alone cage versus anterior plate construct in anterior cervical discectomy and fusion: a systematic review and meta-analysis based on randomized controlled trials<sup>87</sup>  
<https://dx.doi.org/10.1007/s00586-020-06561-x>
- Incidence of Subsidence of Seven Intervertebral Devices in Anterior Cervical Discectomy and Fusion: A Network Meta-Analysis<sup>88</sup>  
<https://dx.doi.org/10.1016/j.wneu.2020.03.130>
- Zero-profile versus cage-plate interbody fusion system in anterior cervical discectomy and fusion for the treatment of multilevel cervical spondylosis: A protocol of systematic review and meta-analysis<sup>89</sup>  
<https://dx.doi.org/10.1097/MD.00000000000022026>

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## Appendix A: Methods

We assessed nomination for priority for a systematic review or other AHRQ Effective Health Care report with a hierarchical process using established selection criteria. Assessment of each criteria determined the need to evaluate the next one. See Appendix B for detailed description of the criteria.

### Appropriateness and Importance

We assessed the nomination for appropriateness and importance.

### Desirability of New Review/Absence of Duplication

We searched for high-quality, completed or in-process evidence reviews published in the last three years August 3, 2021 on the questions of the nomination from these sources:

- AHRQ: Evidence reports and technology assessments
  - AHRQ Evidence Reports <https://www.ahrq.gov/research/findings/evidence-based-reports/index.html>
  - EHC Program <https://effectivehealthcare.ahrq.gov/>
  - US Preventive Services Task Force <https://www.uspreventiveservicestaskforce.org/>
  - AHRQ Technology Assessment Program <https://www.ahrq.gov/research/findings/ta/index.html>
- US Department of Veterans Affairs Products publications
  - Evidence Synthesis Program <https://www.hsrd.research.va.gov/publications/esp/>
  - VA/Department of Defense Evidence-Based Clinical Practice Guideline Program <https://www.healthquality.va.gov/>
- Cochrane Systematic Reviews <https://www.cochranelibrary.com/>
- PROSPERO Database (international prospective register of systematic reviews and protocols) <http://www.crd.york.ac.uk/prospéro/>
- PubMed <https://www.ncbi.nlm.nih.gov/pubmed/>
- Epistemonikos <http://epistemonikos.org>

### Impact of a New Evidence Review

The impact of a new evidence review was qualitatively assessed by analyzing the current standard of care, the existence of potential knowledge gaps, and practice variation. We considered whether it was possible for this review to influence the current state of practice through various dissemination pathways (practice recommendation, clinical guidelines, etc.).

### Feasibility of New Evidence Review

We conducted a limited literature search in PubMed for the last five years August 3, 2016 - August 3, 2021. Because a large number of articles were identified for KQs 1 and 3, we reviewed a random sample of 200 titles and abstracts for those KQs and reviewed all titles and abstracts for all other KQs. We classified identified studies by question and study design, to assess the size and scope of a potential evidence review. We then calculated the projected total number of included studies based on the proportion of studies included from the random sample.

Search strategy

**MEDLINE ALL (Ovid) 1946 to August 02, 2021**

Date searched: August 3, 2021

1 exp Cervical Vertebrae/ and (Hyperostosis, Diffuse Idiopathic Skeletal/ or Intervertebral Disc Degeneration/ or Ossification of Posterior Longitudinal Ligament/ or Radiculopathy/ or Spinal Osteophytosis/ or Spinal Stenosis/ or Spondylosis/) (5960)

2 ((cervical or C1 or C2 or C3 or C4 or C5 or C6 or C7) adj3 (bulging or degenerat\* or degradat\* or deossificat\* or displace\* or hernia\* or ossificat\* or osteophyt\* or pseudarthro\* or radiculopath\* or spondylo\* or stenosis or stenotic or thinning)).ti,kf. (6670)

3 or/1-2 (9874)

4 3 not ((exp Animals/ not Humans/) or (animal or bovine or canine or cat or cats or cow or cows or dog or dogs or feline or mice or mouse or ovine or pig or pigs or porcine or primate\* or rat or rats or rattus or sheep).ti. or (case reports or comment or editorial or guideline or letter or news).pt.) (7227)

5 limit 4 to (english language and yr="2018 -Current") (1737)

6 5 and ((meta-analysis or systematic review).pt. or (metaanal\* or meta-anal\* or ((evidence or scoping or systematic) adj3 (review or synthesis))).ti.) (128)

7 limit 4 to (english language and yr="2016 -Current") (2514)

8 7 not 6 (2386)

9 8 and (dermatome\$1 or "Japanese Orthopaedic" or "Japanese Orthopedic" or myotome\$1 or neurolog\* or nerve or nerves or pain\* or sensory or weak\* or "EQ-5D" or "Neck Disability Index" or "PROMIS-29" or "Short Form 12" or "Visual Analogue Scale").ab. (1491)

10 limit 9 to ("middle aged (45 plus years)" or "all aged (65 and over)" or "aged (80 and over)") (876)

11 exp Cervical Vertebrae/ and Spondylosis/ (1386)

12 cervical spondylotic myelopathy.ti,kf. (1487)

13 or/11-12 (2272)

14 13 not ((exp Animals/ not Humans/) or (animal or bovine or canine or cat or cats or cow or cows or dog or dogs or feline or mice or mouse or ovine or pig or pigs or porcine or primate\* or rat or rats or rattus or sheep).ti. or (case reports or comment or editorial or guideline or letter or news).pt.) (1939)

15 limit 14 to (english language and yr="2018 -Current") (542)

16 15 and ((meta-analysis or systematic review).pt. or (metaanal\* or meta-anal\* or ((evidence or scoping or systematic) adj3 (review or synthesis))).ti.) (27)

17 limit 14 to (english language and yr="2016 -Current") (817)

18 exp Magnetic Resonance Imaging/ or ("magnetic resonance" or MRI).ti,ab,kf. (711742)

19 and/17-18 (273)

20 19 not 16 (273)

21 exp Cervical Vertebrae/ and (Hyperostosis, Diffuse Idiopathic Skeletal/ or Intervertebral Disc Degeneration/ or Ossification of Posterior Longitudinal Ligament/ or Radiculopathy/ or Spinal Osteophytosis/ or Spinal Stenosis/ or Spondylosis/) (5960)

22 ((cervical or C1 or C2 or C3 or C4 or C5 or C6 or C7) adj3 (bulging or degenerat\* or degradat\* or deossificat\* or displace\* or hernia\* or ossificat\* or osteophyt\* or pseudarthro\* or radiculopath\* or spondylo\* or stenosis or stenotic or thinning)).ti,kf. (6670)

23 or/21-22 (9874)

24 Laminectomy/ or Laminoplasty/ or Spinal Fusion/ or (ACDF or anterior or fusion or laminectom\* or laminoplast\* or posterior or surger\* or surgical\*).ti,ab,kf. (2642265)

25 and/23-24 (6429)

26 25 not ((exp Animals/ not Humans/) or (animal or bovine or canine or cat or cats or cow or cows or dog or dogs or feline or mice or mouse or ovine or pig or pigs or porcine or primate\* or rat or rats or rattus or sheep).ti. or (case reports or comment or editorial or guideline or letter or news).pt.) (4896)

27 limit 26 to (english language and yr="2018 -Current") (1342)



28 27 and ((meta-analysis or systematic review).pt. or (metaanal\* or meta-anal\* or ((evidence or scoping or systematic) adj3 (review or synthesis))).ti.) (94)

29 limit 26 to (english language and yr="2016 -Current") (1951)

30 29 not 28 (1857)

31 limit 30 to ("middle aged (45 plus years)" or "all aged (65 and over)" or "aged (80 and over)") (1059)

32 exp Cervical Vertebrae/ and Spondylosis/ (1386)

33 cervical spondylotic myelopathy.ti,kf. (1487)

34 or/32-33 (2272)

35 (neuromonitor\* or neuro-monitor\* or "motor evoked potential" or somatosens\*).ti,ab,kf. (36373)

36 and/34-35 (70)

37 36 not ((exp Animals/ not Humans/) or (animal or bovine or canine or cat or cats or cow or cows or dog or dogs or feline or mice or mouse or ovine or pig or pigs or porcine or primate\* or rat or rats or rattus or sheep).ti. or (case reports or comment or editorial or guideline or letter or news).pt.) (65)

38 limit 37 to (english language and yr="2018 -Current") (15)

39 38 and ((meta-analysis or systematic review).pt. or (metaanal\* or meta-anal\* or ((evidence or scoping or systematic) adj3 (review or synthesis))).ti.) (1)

40 limit 37 to (english language and yr="2016 -Current") (22)

41 40 not 39 (21)

42 exp Cervical Vertebrae/ and (Radiculopathy/ or Spondylosis/) (2363)

43 ((cervical or C1 or C2 or C3 or C4 or C5 or C6 or C7) and (radiculopath\* or spondylo\* or myelopath\*).ti,kf. (6333)

44 or/42-43 (7338)

45 exp Arthroplasty/ or exp Diskectomy/ or (arthroplast\* or diskectom\*).ti,ab,kf. (108561)

46 and/44-45 (824)

47 46 not ((exp Animals/ not Humans/) or (animal or bovine or canine or cat or cats or cow or cows or dog or dogs or feline or mice or mouse or ovine or pig or pigs or porcine or primate\* or rat or rats or rattus or sheep).ti. or (case reports or comment or editorial or guideline or letter or news).pt.) (709)

48 limit 47 to (english language and yr="2018 -Current") (212)

49 48 and ((meta-analysis or systematic review).pt. or (metaanal\* or meta-anal\* or ((evidence or scoping or systematic) adj3 (review or synthesis))).ti.) (18)

50 limit 47 to (english language and yr="2016 -Current") (319)

51 50 not 49 (301)

52 limit 51 to ("middle aged (45 plus years)" or "all aged (65 and over)" or "aged (80 and over)") (212)

53 exp Cervical Vertebrae/ and Pseudarthrosis/ (205)

54 ((cervical or C1 or C2 or C3 or C4 or C5 or C6 or C7) and (pseudarthro\* or pseudoarthro\*).ti,ab,kf. (683)

55 or/53-54 (771)

56 (exp Cervical Vertebrae/ and Spinal Fusion/) or (anterior and (cervical or C1 or C2 or C3 or C4 or C5 or C6 or C7) and fusion).ti,ab,kf. (10044)

57 and/55-56 (508)

58 57 not ((exp Animals/ not Humans/) or (animal or bovine or canine or cat or cats or cow or cows or dog or dogs or feline or mice or mouse or ovine or pig or pigs or porcine or primate\* or rat or rats or rattus or sheep).ti. or (case reports or comment or editorial or guideline or letter or news).pt.) (443)

59 limit 58 to (english language and yr="2018 -Current") (98)

60 59 and ((meta-analysis or systematic review).pt. or (metaanal\* or meta-anal\* or ((evidence or scoping or systematic) adj3 (review or synthesis))).ti.) (7)

61 limit 58 to (english language and yr="2016 -Current") (136)

### **Cochrane Central Register of Controlled Trials (Ovid EBM Reviews) June 2021**

Date searched: August 3, 2021

1 exp Cervical Vertebrae/ and (Hyperostosis, Diffuse Idiopathic Skeletal/ or Intervertebral Disc Degeneration/ or Ossification of Posterior Longitudinal Ligament/ or Radiculopathy/ or Spinal Osteophytosis/ or Spinal Stenosis/ or Spondylosis/) (249)

2 ((cervical or C1 or C2 or C3 or C4 or C5 or C6 or C7) adj3 (bulging or degenerat\* or degradat\* or deossificat\* or displace\* or hernia\* or ossificat\* or osteophyt\* or pseudarthro\* or radiculopath\* or spondylo\* or stenosis or stenotic or thinning)).ti,ab. (1776)

3 or/1-2 (1831)

4 3 and (dermatome\$1 or "Japanese Orthopaedic" or "Japanese Orthopedic" or myotome\$1 or neurolog\* or nerve or nerves or pain\* or sensory or weak\* or "EQ-5D" or "Neck Disability Index" or "PROMIS-29" or "Short Form 12" or "Visual Analogue Scale").ab. (1152)

5 4 not (animal or bovine or canine or cat or cats or cow or cows or dog or dogs or feline or mice or mouse or ovine or pig or pigs or porcine or primate\* or rat or rats or rattus or sheep).ti. (1152)

6 limit 5 to (english language and yr="2016 -Current") (292)

7 exp Cervical Vertebrae/ and Spondylosis/ (61)

8 ((cervical or C1 or C2 or C3 or C4 or C5 or C6 or C7) and (spondylo\* or myelopath\*)).ti,ab. (1137)

9 or/7-8 (1147)

10 exp Magnetic Resonance Imaging/ or ("magnetic resonance" or MRI).ti,ab. (37647)

11 and/9-10 (115)

12 11 not (animal or bovine or canine or cat or cats or cow or cows or dog or dogs or feline or mice or mouse or ovine or pig or pigs or porcine or primate\* or rat or rats or rattus or sheep).ti. (115)

13 limit 12 to (english language and yr="2016 -Current") (24)

14 exp Cervical Vertebrae/ and (Hyperostosis, Diffuse Idiopathic Skeletal/ or Intervertebral Disc Degeneration/ or Ossification of Posterior Longitudinal Ligament/ or Radiculopathy/ or Spinal Osteophytosis/ or Spinal Stenosis/ or Spondylosis/) (249)

15 ((cervical or C1 or C2 or C3 or C4 or C5 or C6 or C7) adj3 (bulging or degenerat\* or degradat\* or deossificat\* or displace\* or hernia\* or ossificat\* or osteophyt\* or pseudarthro\* or radiculopath\* or spondylo\* or stenosis or stenotic or thinning)).ti,ab. (1776)

16 or/14-15 (1831)

17 Laminectomy/ or Laminoplasty/ or Spinal Fusion/ or (ACDF or anterior or fusion or laminectom\* or laminoplast\* or posterior or surger\* or surgical\*).ti,ab. (245230)

18 and/16-17 (901)

19 18 not (animal or bovine or canine or cat or cats or cow or cows or dog or dogs or feline or mice or mouse or ovine or pig or pigs or porcine or primate\* or rat or rats or rattus or sheep).ti. (901)

20 limit 19 to (english language and yr="2016 -Current") (246)

21 exp Cervical Vertebrae/ and Spondylosis/ (61)

22 ((cervical or C1 or C2 or C3 or C4 or C5 or C6 or C7) and (spondylo\* or myelopath\*)).ti,ab. (1137)

23 or/21-22 (1147)

24 (neuromonitor\* or neuro-monitor\* or "motor evoked potential" or somatosens\*).ti,ab. (2308)

25 and/23-24 (13)

26 25 not (animal or bovine or canine or cat or cats or cow or cows or dog or dogs or feline or mice or mouse or ovine or pig or pigs or porcine or primate\* or rat or rats or rattus or sheep).ti. (13)

27 limit 26 to (english language and yr="2016 -Current") (0)

28 exp Cervical Vertebrae/ and (Radiculopathy/ or Spondylosis/) (142)

29 ((cervical or C1 or C2 or C3 or C4 or C5 or C6 or C7) and (radiculopath\* or spondylo\* or myelopath\*)).ti,ab. (1489)

30 or/28-29 (1519)

31 exp Arthroplasty/ or exp Diskectomy/ or (arthroplast\* or diskectom\*).ti,ab. (13580)

32 and/30-31 (170)

33 32 not (animal or bovine or canine or cat or cats or cow or cows or dog or dogs or feline or mice or mouse or ovine or pig or pigs or porcine or primate\* or rat or rats or rattus or sheep).ti. (170)

34 limit 33 to (english language and yr="2016 -Current") (49)

35 exp Cervical Vertebrae/ and Pseudarthrosis/ (5)

36 ((cervical or C1 or C2 or C3 or C4 or C5 or C6 or C7) and (pseudarthro\* or pseudoarthro\*)).ti,ab. (42)

37 or/35-36 (42)

38 (exp Cervical Vertebrae/ and Spinal Fusion/) or (anterior and (cervical or C1 or C2 or C3 or C4 or C5 or C6 or C7) and fusion).ti,ab. (787)

39 and/37-38 (32)

40 39 not (animal or bovine or canine or cat or cats or cow or cows or dog or dogs or feline or mice or mouse or ovine or pig or pigs or porcine or primate\* or rat or rats or rattus or sheep).ti. (32)

41 limit 40 to (english language and yr="2016 -Current") (6)

[CT.gov link](#)

## **Value**

We assessed the nomination for value. We considered whether or not the clinical, consumer, or policymaking context had the potential to respond with evidence-based change; and if a partner organization would use this evidence review to influence practice.

## Appendix B. Selection Criteria Assessment

Selection Criteria	Assessment
<b>1. Appropriateness</b>	
1a. Does the nomination represent a health care drug, intervention, device, technology, or health care system/setting available (or soon to be available) in the US?	Yes.
1b. Is the nomination a request for an evidence report?	Yes.
1c. Is the focus on effectiveness or comparative effectiveness?	Yes.
1d. Is the nomination focus supported by a logic model or biologic plausibility? Is it consistent or coherent with what is known about the topic?	Yes.
<b>2. Importance</b>	
2a. Represents a significant disease burden; large proportion of the population	Yes. Cervical degenerative disease is associated with older age, and about 27% of the Medicare population is diagnosed with the condition annually. The prevalence of cervical degeneration increases with age and is expected to increase as the proportion of the population of people over age 60 increases.
2b. Is of high public interest; affects health care decision making, outcomes, or costs for a large proportion of the US population or for a vulnerable population	Yes. Cervical degenerative disease is associated with older age, and about 27% of the Medicare population is diagnosed with the condition annually. The prevalence of cervical degeneration increases with age and is expected to increase as the proportion of the population of people over age 60 increases.
2c. Incorporates issues around both clinical benefits and potential clinical harms	Yes.
2d. Represents high costs due to common use, high unit costs, or high associated costs to consumers, to patients, to health care systems, or to payers	Yes. Cervical degenerative disease is associated with older age, and about 27% of the Medicare population is diagnosed with the condition annually. The prevalence of cervical degeneration increases with age and is expected to increase as the proportion of the population of people over age 60 increases.
<b>3. Desirability of a New Evidence Review/Absence of Duplication</b>	
3. A recent high-quality systematic review or other evidence review is not available on this topic	Yes. We did not find any recent high-quality SRs that would obviate the need for a new SR.
<b>4. Impact of a New Evidence Review</b>	
4a. Is the standard of care unclear (guidelines not available or guidelines inconsistent, indicating an information gap that may be addressed by a new evidence review)?	Yes. The current guidelines for management of cervical degenerative disease were published in 2009. New evidence has been published since then, and a new systematic review would inform the development of an updated guideline to inform practice.
4b. Is there practice variation (guideline inconsistent with current practice, indicating a potential implementation gap and not best addressed by a new evidence review)?	Yes. The current guidelines for management of cervical degenerative disease were published in 2009. New evidence has been published since then, and a new systematic review would inform the development of an updated guideline to inform practice.
<b>5. Primary Research</b>	

<p>5. Effectively utilizes existing research and knowledge by considering:</p> <ul style="list-style-type: none"> <li>- Adequacy (type and volume) of research for conducting a systematic review</li> <li>- Newly available evidence (particularly for updates or new technologies)</li> </ul>	<p>Size/scope of review:</p> <ul style="list-style-type: none"> <li>• KQ1, 2 studies (from sample of 200 studies)</li> <li>• KQ2, 13 studies</li> <li>• KQ3, 10 studies (from sample of 200 studies)</li> <li>• KQ4, 0 studies</li> <li>• KQ5, 48 studies</li> <li>• KQ6, 0 studies</li> <li>• KQ7, 1 study</li> </ul> <p>The SR size is estimated to be medium.</p>
<p>6. Value</p>	
<p>6a. The proposed topic exists within a clinical, consumer, or policy-making context that is amenable to evidence-based change</p>	<p>Yes. A new systematic review would inform the development of an updated guideline to inform practice.</p>
<p>6b. Identified partner who will use the systematic review to influence practice (such as a guideline or recommendation)</p>	<p>Yes. The nominators would use a new systematic review would inform the development of an updated guideline to inform practice.</p>

Abbreviations: AHRQ=Agency for Healthcare Research and Quality; KQ=key question; SR=systematic review; US=United States.

## Appendix C. Topic Nomination

### 0955 Surgical Management of Cervical Degenerative Disease Topic Nomination

A topic nomination was submitted on the EHC website:  
Submitted on Friday, June 11, 2021 - 09:36

==Topic Suggestion==

1. What is the decision or change you are facing or struggling with where a summary of the evidence would be helpful?

The authors want to assess the most current and clinically relevant evidence for the surgical management of patients with cervical degenerative disease. Authors published guidelines in 2009 including evidence published from 1966–2007. Fortunately, new research is has been published on this topic, and these guidelines are meant to be updated as new evidence emerges. The authors will develop a new guideline based on a new systematic review based on more recently published literature on this topic.

2. Why are you struggling with this issue?

Cervical degenerative disease is the most common cause of acquired disability in patients over the age of 50. Cervical spondylotic myelopathy is a challenging condition. A large number of patients are severely, and in our opinion, unnecessarily disabled by this preventable condition. Since the publication of the 2009 guideline, new technologies in arthrodesis and biological agents remain areas of intense investigation.

This systematic review would help inform a clinical practice guideline to synthesize new evidence on this topic to help inform decision-making for providers and better patient outcomes.

3. What do you want to see changed? How will you know that your issue is improving or has been addressed?

We would like to explore the following questions related to this topic:

#### **Prognosis of cervical degenerative conditions**

1. Does surgical treatment compared to non-operative treatment improve neurologic outcomes in patients with mild or no cervical spondylotic myelopathy?

2. Do patients with mild myelopathy have better neurologic recovery after surgery compared to those with moderate or severe myelopathy? (\*Note: this is the "timing of surgery" question, which I think will be difficult to study, i.e. how do you define early surgery? Does this essentially boil down to operating when someone has mild myelopathy versus when it progresses to moderate?)

3. Do preoperative MRI findings predict likelihood of neurologic recovery after surgical treatment for cervical spondylotic myelopathy?

#### **Surgical treatment**

1. For patients with cervical radiculopathy, does anterior surgery result in improved outcomes compared to posterior surgery?

2. For patients with  $\geq 3$  levels of disease, is posterior surgery associated with better outcome and fewer approach-related complications than anterior surgery?

3. For patients with cervical spondylotic myelopathy, does cervical laminectomy and fusion improve neurologic recovery and/ or neck pain compared to cervical laminoplasty?

4. Does the use of intraoperative neuromonitoring improve clinical outcomes in patients undergoing surgery for cervical spondylotic myelopathy?

#### **Adjacent segment disease and pseudarthrosis**

1. Does the choice of interbody graft or device type effect radiologic fusion rates in patients undergoing anterior cervical discectomy and fusion?

2. In patients with cervical spondylotic radiculopathy or myelopathy at 1 or 2 levels, does cervical arthroplasty decrease the risk of symptomatic adjacent segment disease and/ or reoperation rates compared to anterior cervical discectomy and fusion?
3. What imaging assessment provides greatest sensitivity and specificity for symptomatic pseudarthrosis after prior cervical fusion surgery?
4. In patients with pseudarthrosis after prior anterior cervical fusion surgery, do posterior approaches for arthrodesis improve clinical outcomes and/or fusion rates compared to revision anterior arthrodesis?

4. When do you need the evidence report? Wed, 03/01/2023

5. What will you do with the evidence report?

The purpose of this topic nomination is to evaluate all available evidence, from which, the Congress of Neurological Surgeons (CNS) will develop a guideline to aid clinicians and guide clinical practice by determining the best options for the surgical management of cervical degenerative disease.

The CNS maintains in-house infrastructure to lead, promote, and support the creation and methodological processes to produce evidence-based guidelines, which are critical tools to confront a rapidly changing health care environment. Using the CNS's high quality, rigorous methodological process, a multidisciplinary task force will develop recommendations based on the available evidence provided by the Evidence Based Practice Center. Throughout development, the task force will use evidence-based methodologies and strictly adhere to a priori defined criteria as defined by the Institute of Medicine's (IOM) standards for conducting systematic reviews and clinical evidence-based guidelines.

This topic was initiated by the Spine and Peripheral Nerves of the American Academy of Neurological Surgeons (AANS)/CNS. The CNS also recruited from a variety of institutions and subspecialty disciplines in an effort to have as broad a representation of opinions and expertise as possible. It is CNS's goal to follow the IOM recommendations to be inclusive and interdisciplinary

when constructing our guidelines and subsequent recommendations. A conscientious effort will also be made to be sure that any conflict of interest is fully disclosed and avoided. Participants who have published extensively in certain areas will be asked to recuse themselves from voting and will be assigned to evaluate evidence in other topics. Every effort will be made to ensure that the guideline is accurate, reliable, and non-biased.

The CNS guidelines attempt to provide essential information for clinicians, globally, helping to improve patient care and outcomes. In addition to developing high quality guidelines, CNS is also committed to dissemination of guidelines in multiple, open access formats, such as publication in peer-reviewed journals, publication on the CNS webpage, webinars, conference seminars and courses, as well as other promotional efforts.

==(Optional) About You==

What is your role or perspective? Professional Society

If you are you making a suggestion on behalf of an organization, please state the name of the organization: Congress of Neurological Surgeons

May we contact you if we have questions about your nomination? Yes

First and Last Name: Patricia Rehring

Title: Associate Director of Evidence Based Practice Initiatives

Email Address: trehring@cns.org

The results of this submission may be viewed at:

<https://effectivehealthcare.ahrq.gov/node/16119/submission/20667>