



Topic Brief: Acute Cervical Spine and Spinal Cord Injury Guidelines

Date: 7/26/2023

Nomination Number: 1035

Purpose: This document summarizes the information addressing a nomination submitted on November 17, 2022 through the Effective Health Care Website: [Link to nomination](#). This information was used to inform the Evidence-based Practice Center (EPC) Program on decisions about whether to produce an evidence report on the topic, and if so, what type of evidence report would be most suitable.

Issue: Injuries to the cervical spinal column include damage to ligamentous structures and, in some cases, bony fractures. Due to the proximity of the spinal cord, such injuries can cause severe and often permanent neurological damage that result in reduced physical abilities. Medical care in the period immediately after the acute injury is important for stabilizing the bony support of the spinal cord, reducing re-injuries, and facilitating rehabilitation. Better evidence potentially can optimize this care.

Findings The scope of this topic met all EHC Program selection criteria and was considered for a systematic review. However, it was not selected.

Background

Worldwide, between 250,00 and 500,00 people suffer acute injuries of the cervical spine and spinal cord each year.¹ These injuries can be devastating and lead to severe long-term neurological deficits. The medical and surgical care of such injuries is complex and often requires coordination among multiple providers, including first responders, emergency departments, imaging facilities, surgical providers, and rehabilitation specialists. The Congress of Neurological Surgeons (CNS) has disseminated practice guidelines for the care of these acute injuries. Its first guidelines were released as a single publication in 2002.² In 2013 CNS released an expanded and updated set of guidelines in the form of 22 articles in a Supplement to the journal *Neurosurgery*. The guidelines included recommendations on pre-hospital care, clinical and radiographic assessment, management of cervical dislocations, surgical repair, supportive care, neurological care, care of vascular complications, and nutritional support. The guidelines also included a separate publication on the care of pediatric patients.³

The methodology for the CNS guidelines used PubMed searches for the time-period 1966-2011. Formal systematic reviews were not performed. Instead, a nine-member author group reviewed the literature searches and rated the strength of evidence.⁴ The recommendations used a rating scheme previously proposed by the North American Spine Society.^{5,6} This schema classifies the evidence as coming from randomized controlled trials or observational studies using categories

of I, II, and III (with I denoting the greatest strength of evidence). If a recommendation was based only on expert opinion, then no numerical rating was assigned.

Nomination Summary

CNS has determined that, due to the time that has elapsed since release of the 2013 guidelines, the guidelines should be updated within the next two years. It originally requested a broad systematic review addressing most parts of the 2013 guidelines. After a discussion with AHRQ and the SRC, CNS identified six chapters of the guidelines that are its highest priority for updating.^{3, 7-11}

Scope

1. What is the effectiveness and harms of operative treatment for craniocervical traumatic fractures?
2. What is the effectiveness of cardiopulmonary and/or pharmacologic interventions in adults with acute cervical spinal cord injury?
3. What is the comparative effectiveness of imaging types to identify fractures and soft tissue injuries in pediatric patients with acute cervical spinal cord injury?

Table 1. Questions and PICOTS (population, intervention, comparator, outcome, timing, and setting)

| Questions | Operative treatment | Cardiopulmonary and/or pharmacologic interventions | Pediatric imaging |
|----------------------|--|--|--|
| Population | Adults with fractures involving the C1 and C2 vertebrae, including associated ligamentous injuries | Adults (≥ 18 years) with acute cervical spinal cord injury | Children (≤ 18 years) with acute cervical spine injury |
| Interventions | Operative treatments such as odontoid screws, occipitocervical fusion, C1-C2 fusion, subaxial cervical pedicle screws, subaxial lateral mass screws, anterior cervical corpectomy and fusion, or anterior cervical discectomy and fusion | Cardiopulmonary: tracheostomy (open and percutaneous), diaphragmatic stimulation (e.g., diaphragmatic pacing) Pharmacologic: Anti-RGMA monoclonal antibody for neuroprotection/neuroplasticity/neurorecovery (elezanumab) Anti-inflammatory agents (e.g., riluzole, IVIG, minocycline, and G-CSF; steroids-preoperative or intraoperative) | Imaging (x-ray, whole body CT scan, MRI, Non-contrast, MDCT) |
| Comparators | Nonoperative treatments, no treatment, or other types of surgeries | Placebo/control/TAU, other intervention | Other types of imaging |

| | | | |
|-----------------|---|---|---|
| Outcomes | <ul style="list-style-type: none"> Medical outcomes: improvement in neurologic examination or worsening deformity and/or non-fusion, mortality Clinical outcomes: pain, function, quality of life, harms of surgery | <ul style="list-style-type: none"> Medical outcomes: pneumonia, mortality, ventilator dependence Clinical outcomes: quality of life, harm of intervention | <ul style="list-style-type: none"> Medical outcomes: fractures (linear fractures such as odontoid fractures versus os odontoideum), soft tissue injury such as ligamentous injuries <ul style="list-style-type: none"> Flexion injury: facet dislocation, tear drop fracture, locked facets Extension injury: Fracture of spinous process, lamina, lateral mass Neutral position injury: burst fracture. Clinical outcomes: harms |
| Timing | Acute injury within 30 days | Acute injury (i.e., symptoms present for no longer than a year) | Acute injury (i.e., symptoms present for no longer than a year) |
| Setting | Inpatient hospital settings | Emergency departments and inpatient settings | Inpatient or outpatient settings |

Abbreviations: IVIG=intravenous immune globulin; (MD)CT=(multidetector) computerized tomography; MRI=magnetic resonance imaging; RGMa=repulsive guidance molecule-a; TAU=treatment as usual.

Assessment Methods

We assessed the nomination for priority for a systematic review or other AHRQ EHC report with a hierarchical process using established selection criteria. Assessment of each criterion determined the need to evaluate the next one.

1. Determine the *appropriateness* of the nominated topic for inclusion in the EHC program.
2. Establish the overall *importance* of a potential topic as representing a health or healthcare issue in the United States.
3. Determine the *desirability of new evidence review* by examining whether a new systematic review or other AHRQ product would be duplicative.
4. Assess the *potential impact* a new systematic review or other AHRQ product.
5. Assess whether the *current state of the evidence* allows for a systematic review or other AHRQ product (feasibility).
6. Determine the *potential value* of a new systematic review or other AHRQ product.

See Appendix A.

Summary of Literature Findings

A new systematic review may provide assistance to CNS for updating its recommendations in its guidelines. We performed an Ovid Medline search covering the time period January 1, 2020 through May 10, 2023. Across the three key questions, we identified no recent, high quality systematic reviews that covered the scope of the nomination and 18 primary studies addressing the nomination.

Key Question 1 addresses evidence pertaining to three of the CNS guideline documents, all of which address surgical management of fractures of the C1 and/or C2 vertebrae.^{8,9,11} In these three documents, there is one level II recommendation and several level III recommendations. Our literature search identified only one experimental primary study and the rest used observational study designs.

Key Question 2 addresses medical support for acutely injured patients. The new literature that was identified primarily addresses two management interventions: tracheostomy and new neuroprotective agents. The RCTs evaluating neuroprotective agents examined riluzole (two trials), one trial examining a rho inhibitor, and one examining human hepatocyte growth factor. The neuroprotective agent that has been studied the most is riluzole, an agent currently approved for the treatment of amyotrophic lateral sclerosis. None of the agents studied in these recent RCTs were addressed in the 2013 CNS guidelines.

The two published studies on ventilator management addressed timing of tracheostomy (two retrospective cohort studies). These issues are relevant to a broad category of intensive care patients who require long-term ventilator management, and several systematic reviews have recently been published on this topic.

Key Question 3 addresses the use of imaging in children with acute spinal cord injury. We did not find any studies addressing this question.

Table 2. Literature identified for each Question

| Question | Systematic reviews (5/2020-5/2023) | Primary studies (5/2018-5/2023) |
|---|---|---|
| Question 1: Operative treatment | Total: 0 | Total: 10 ¹²⁻²¹ <ul style="list-style-type: none"> • Non-randomized experimental: 1 • Observational: 9 Clinicaltrials.gov <ul style="list-style-type: none"> • Recruiting: 0 |
| Question 2: Cardiopulmonary and/or pharmacologic interventions | Total: 0 | Total: 8 ²²⁻²⁹ Cardiopulmonary <ul style="list-style-type: none"> • Observational: 2 Pharmacological <ul style="list-style-type: none"> • RCT: 4 • Observational: 2 Clinicaltrials.gov <ul style="list-style-type: none"> • Recruiting: 0 |
| Question 3: Pediatric imaging | Total: 0 | Total: 0 Clinicaltrials.gov <ul style="list-style-type: none"> • Recruiting: 0 |

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

Summary of Selection Criteria Assessment

Because the CNS guidelines on the care of patients with acute spinal cord injury were published in 2013, it is timely to conduct a thorough review and update of the guideline recommendations. Such a review should be based on updated literature searches and evidence syntheses.

The current CNS guidelines predominately are recommendations based on level II or level III evidence. Our literature search covering 2018-2023 indicates that new research is predominantly either early stage small RCTs or observational studies. There were few (KQs 1 and 2) to no (KQ 3) primary studies addressing the Key Questions.

Please see Appendix B for detailed assessments of individual EPC Program selection criteria.

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Author

David Hickam

Robin Paynter

Mark Helfand

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Charli Armstrong

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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 May 10, 2020 - May 10, 2023 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/prospero/>
- PubMed <https://www.ncbi.nlm.nih.gov/pubmed/>
- Joanna Briggs Institute <http://joannabriggs.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 time-period January 1, 2020 -May 10, 2023. We assessed all studies identified by reviewing their titles and abstracts for inclusion.

Search strategy

KQ 1

Ovid Medline ALL 1946 to May 09,2023

Date searched: May 10, 2023

1 (Axis, Cervical Vertebra/ or Odontoid Process/ or Cervical Atlas/) and ((accident* or break* or broken or collision* or crash\$2 or dislocat* or dissociat* or faceplant* or fall\$1 or falling or fracture* or hyperextension\$1 or hyper-extension\$1 or injur* or "motor vehicle" or posttrauma*

or traffic or trauma* or wound*) and (corperctom* or discectom* or fixation\$1 or fusion* or operati* or screw* or surg*).ti,ab,kf. (1438)

2 ((atlantoaxial or atlanto* or atlas or ((axial or axis) and (cervical or neck)) or ((axial or axis) adj fracture\$1) or C1 or "C1/2" or C2 or CCJ or CVJ or craniocervical or cranio-cervical or craniovertebr* or cranio-vertebr* or hangman\$2 or odontoid\$2 or "processus epitrophysis") and (accident* or break* or broken or collision* or crash\$2 or dislocat* or dissociat* or faceplant* or fall\$1 or falling or fracture* or hyperextension\$1 or hyper-extension\$1 or injur* or "motor vehicle" or posttrauma* or traffic or trauma* or wound*) and (corperctom* or discectom* or fixation\$1 or fusion* or operati* or screw* or surg*).ti,ab,kf. (7154)

3 or/1-2 (7235)

4 3 not ((exp Animals/ not Humans/) or (animal model* or bitch\$2 or bovine or canine or capra or cat or cats or cattle or cow\$1 or dog\$1 or equine or ewe\$1 or feline or goat\$1 or hamster\$1 or horse\$1 or invertebrate\$1 or macaque\$1 or mare\$1 or mice or monkey\$1 or mouse or murine or nonhuman or non-human or ovine or pig or pigs or porcine or primate\$1 or rabbit\$1 or rat\$1 or rattus or rhesus or rodent* or sheep or simian or sow\$1 or vertebrate\$1 or zebrafish).ti. or (ankle\$1 or arthritis or cataract\$1 or coronary or "chron's" or elbow\$1 or femur\$1 or femoral or fibula\$1 or hip or humerus or humeral or inguinal* or knee or knees or lumbar or meniscus or meniscal or patella\$1 or pelvis or pelvic or radial or radius or sacroiliac or scoliosis or talus or tarso* or thoracolumbar or tibia\$1 or ulna\$1 or vitrectom*).ti. or (adolescen* or boys or child* or girls or juvenile or paediat* or pediat* or prepubescen* or pubescen* or school* or student\$1 or teen* or young).ti. or ("case report" or comment or commentary).ti. or (case reports or comments or editorials or letters).pt.) (3815)

5 limit 4 to ("all aged (65 and over)" or "aged (80 and over)") (1312)

6 4 and (aged or elder\$2 or frail or geriatr* or geront* or nonagen* or octogen* or older or senior or septuagen* or sexagen*).ti,ab,kf. (466)

7 or/5-6 (1494)

8 limit 7 to english language (1263)

9 limit 8 to yr="2020 -Current" (189)

10 (meta-analysis or review or systematic review).pt. or (meta-anal* or metaanal* or ((evidence or review or scoping or systematic or umbrella) adj3 (review or synthesis))).ti. (3518206)

11 and/9-10 (11)

12 limit 8 to yr="2018 -Current" (374)

13 (controlled clinical trial or randomized controlled trial).pt. or (control or controls or controlled or placebo\$1 or random* or trial*).ti,ab,kf. (5803446)

14 and/12-13 (53)

15 14 not 11 (51)

16 Cohort Studies/ or Comparative Study/ or Follow-Up Studies/ or Longitudinal Studies/ or Prospective Studies/ or Retrospective Studies/ or (cohort\$1 or ((comparative or evaluation) adj3 study) or follow-up or longitudinal\$2 or prospective\$2 or retrospective\$2).ti,kf. (4241066)

17 and/12,16 (224)

18 17 not (11 or 15) (194)

Ovid EBM Reviews Cochrane Central Register of Controlled Trials April 2023

Date searched: May 10, 2023

1 (Axis, Cervical Vertebra/ or Odontoid Process/ or Cervical Atlas/) and ((accident* or break* or broken or collision* or crash\$2 or dislocat* or dissociat* or faceplant* or fall\$1 or falling or fracture* or hyperextension\$1 or hyper-extension\$1 or injur* or "motor vehicle" or posttrauma* or traffic or trauma* or wound*) and (corperctom* or discectom* or fixation\$1 or fusion* or operati* or screw* or surg*).ti,ab,kf. (7)

2 ((atlantoaxial or atlanto* or atlas or ((axial or axis) and (cervical or neck)) or ((axial or axis) adj fracture\$1) or C1 or "C1/2" or C2 or CCJ or CVJ or craniocervical or cranio-cervical or craniovertebr* or

cranio-vertebr* or hangman\$2 or odontoid\$2 or "processus epitrochysis") and (accident* or break* or broken or collision* or crash\$2 or dislocat* or dissociat* or faceplant* or fall\$1 or falling or fracture* or hyperextension\$1 or hyper-extension\$1 or injur* or "motor vehicle" or posttrauma* or traffic or trauma* or wound*) and (corperctom* or discectom* or fixation\$1 or fusion* or operati* or screw* or surg*).ti,ab,kf. (360)

3 or/1-2 (361)

4 3 not ((exp Animals/ not Humans/) or (animal model* or bitch\$2 or bovine or canine or capra or cat or cats or cattle or cow\$1 or dog\$1 or equine or ewe\$1 or feline or goat\$1 or hamster\$1 or horse\$1 or invertebrate\$1 or macaque\$1 or mare\$1 or mice or monkey\$1 or mouse or murine or nonhuman or non-human or ovine or pig or pigs or porcine or primate\$1 or rabbit\$1 or rat\$1 or rattus or rhesus or rodent* or sheep or simian or sow\$1 or vertebrate\$1 or zebrafish).ti. or (ankle\$1 or arthritis or cataract\$1 or coronary or "chron's" or elbow\$1 or femur\$1 or femoral or fibula\$1 or hip or humerus or humeral or inguinal* or knee or knees or lumbar or meniscus or meniscal or patella\$1 or pelvis or pelvic or radial or radius or sacroiliac or scoliosis or talus or tarso* or thoracolumbar or tibia\$1 or ulna\$1 or vitrectom*).ti. or (adolescen* or boys or child* or girls or juvenile or paediat* or pediat* or prepubescen* or pubescen* or school* or student\$1 or teen* or young).ti. or ("case report" or comment or commentary).ti. or (case reports or comments or editorials or letters).pt.) (234)

5 4 and (aged or elder\$2 or frail or geriatr* or geront* or nonagen* or octogen* or older or senior or septuagen* or sexagen*).ti,ab,kf. (38)

[KQ1 ClinicalTrials.gov](http://KQ1.ClinicalTrials.gov)

KQ 2

Ovid MEDLINEALL 1946 to May 10, 2023

Date searched: May 11, 2023

1 Cervical Vertebrae/ and (exp Spinal Cord Injuries/ or exp Spinal Injuries/ or exp Spinal Fractures/ or exp Neck Injuries/) (10611)

2 (Atlanto-Axial Joint/ or Atlanto-Occipital Joint/ or Axis, Cervical Vertebra/ or Cervical Atlas/ or Cervical Vertebrae/ or Odontoid Process/) and (accident* or acute or break* or broken or collision* or crash\$2 or "critical care" or dislocat* or dissociat* or faceplant* or fall\$1 or falling or fracture* or hyperextension\$1 or hyper-extension\$1 or injur* or "intensive care" or ICU or "motor vehicle" or posttrauma* or traffic or trauma* or wound*).ti,ab,kf. (16596)

3 (atlanto* or atlas or ((axial or axis) and (cervical or neck)) or ((axial or axis) adj fracture\$1) or C1 or "C1/2" or C2 or C3 or C4 or C5 or C6 or C7 or CCJ or CVJ or (cervical adj2 (spinal or spine)) or craniocervical or cranio-cervical or craniovertebr* or cranio-vertebr* or "critical care" or hangman\$2 or "intensive care" or ICU or ICUs or neck or occipitocervical or "occipito-cervical" or odontoid\$2 or "processus epitrochysis" or UCS).ti,ab,kf. (732074)

4 or/1-3 (736737)

5 (Diaphragm/ and (Electric Stimulation Therapy/ or Electrodes, Implanted/ or (pacing or stimulat*).ti,ab,kf.)) or Tracheostomy/ (11313)

6 ((diaphragm* adj2 (pacing or stimulat*)) or tracheostom*).ti,ab,kf. (18132)

7 or/5-6 (22359)

8 and/4,7 (5734)

9 8 not ((exp Animals/ not Humans/) or (animal model* or bitch\$2 or bovine or canine or capra or cat or cats or cattle or cow\$1 or dog\$1 or equine or ewe\$1 or feline or goat\$1 or hamster\$1 or horse\$1 or invertebrate\$1 or macaque\$1 or mare\$1 or mice or monkey\$1 or mouse or murine or nonhuman or non-human or ovine or pig or pigs or porcine or primate\$1 or rabbit\$1 or rat\$1 or rattus or rhesus or rodent* or sheep or simian or sow\$1 or vertebrate\$1 or zebrafish).ti. or (ankle\$1 or arthritis or cancer* or cataract\$1 or coronary or "chron's" or elbow\$1 or femur\$1 or femoral or fibula\$1 or hip or humerus or humeral or inguinal* or knee or knees or lumbar or meniscus or meniscal or patella\$1 or pelvis or pelvic or radial or radius or sacroiliac or scoliosis

or talus or tarso* or thoracolumbar or tibia\$1 or ulna\$1 or vitrectom*).ti. or (adolescen* or boys or child* or girls or juvenile or paediat* or pediat* or prepubescen* or pubescen* or school* or student\$1 or teen* or young).ti. or ("case report" or comment or commentary).ti. or (case reports or comments or editorials or letters).pt.) (3816)

10 limit 9 to ("all aged (65 and over)" or "aged (80 and over)") (1295)

11 9 and (aged or elder\$2 or frail or geriatr* or geront* or nonagen* or octogen* or older or senior or septuagen* or sexagen*).ti,ab,kf. (275)

12 or/10-11 (1424)

13 limit 12 to english language (1282)

14 limit 13 to yr="2020 -Current" (234)

15 (meta-analysis or review or systematic review).pt. or (meta-anal* or metaanal* or ((evidence or review or scoping or systematic or umbrella) adj3 (review or synthesis))).ti. (3517768)

16 and/14-15 (9)

17 limit 13 to yr="2018 -Current" (376)

18 (controlled clinical trial or randomized controlled trial).pt. or (control or controls or controlled or placebo\$1 or random* or trial*).ti,ab,kf. (5802986)

19 and/17-18 (77)

20 19 not 16 (75)

21 Cohort Studies/ or Comparative Study/ or Follow-Up Studies/ or Longitudinal Studies/ or Prospective Studies/ or Retrospective Studies/ or (cohort\$1 or ((comparative or evaluation) adj3 study) or follow-up or longitudinal\$2 or prospective\$2 or retrospective\$2).ti,kf. (4240627)

22 and/17,21 (285)

23 22 not (16 or 20) (224)

Ovid EBM Reviews - Cochrane Central Register of Controlled Trials April 2023

Date search: May 11, 2023

1 Cervical Vertebrae/ and (exp Spinal Cord Injuries/ or exp Spinal Injuries/ or exp Spinal Fractures/ or exp Neck Injuries/) (7654)

2 (Atlanto-Axial Joint/ or Atlanto-Occipital Joint/ or Axis, Cervical Vertebra/ or Cervical Atlas/ or Cervical Vertebrae/ or Odontoid Process/) and (accident* or acute or break* or broken or collision* or crash\$2 or "critical care" or dislocat* or dissociat* or faceplant* or fall\$1 or falling or fracture* or hyperextension\$1 or hyper-extension\$1 or injur* or "intensive care" or ICU or "motor vehicle" or posttrauma* or traffic or trauma* or wound*).ti,ab,kf. (12132)

3 (atlanto* or atlas or ((axial or axis) and (cervical or neck)) or ((axial or axis) adj fracture\$1) or C1 or "C1/2" or C2 or C3 or C4 or C5 or C6 or C7 or CCJ or CVJ or (cervical adj2 (spinal or spine)) or craniocervical or cranio-cervical or craniovertebr* or cranio-vertebr* or "critical care" or hangman\$2 or "intensive care" or ICU or ICUs or neck or occipitocervical or "occipito-cervical" or odontoid\$2 or "processus epitrophysis" or UCS).ti,ab,kf. (567806)

4 or/1-3 (570665)

5 (Diaphragm/ and (Electric Stimulation Therapy/ or Electrodes, Implanted/ or (pacing or stimulat*).ti,ab,kf.)) or Tracheostomy/ (8940)

6 ((diaphragm* adj2 (pacing or stimulat*)) or tracheostom*).ti,ab,kf. (12774)

7 or/5-6 (15556)

8 and/4,7 (4788)

9 8 not ((exp Animals/ not Humans/) or (animal model* or bitch\$2 or bovine or canine or capra or cat or cats or cattle or cow\$1 or dog\$1 or equine or ewe\$1 or feline or goat\$1 or hamster\$1 or horse\$1 or invertebrate\$1 or macaque\$1 or mare\$1 or mice or monkey\$1 or mouse or murine or nonhuman or non-human or ovine or pig or pigs or porcine or primate\$1 or rabbit\$1 or rat\$1 or rattus or rhesus or rodent* or sheep or simian or sow\$1 or vertebrate\$1 or zebrafish).ti. or (ankle\$1 or arthritis or cancer* or cataract\$1 or coronary or "chron's" or elbow\$1 or femur\$1 or

femoral or fibula\$1 or hip or humerus or humeral or inguinal* or knee or knees or lumbar or meniscus or meniscal or patella\$1 or pelvis or pelvic or radial or radius or sacroiliac or scoliosis or talus or tarso* or thoracolumbar or tibia\$1 or ulna\$1 or vitrectom*).ti. or (adolescen* or boys or child* or girls or juvenile or paediat* or pediat* or prepubescen* or pubescen* or school* or student\$1 or teen* or young).ti. or ("case report" or comment or commentary).ti. or (case reports or comments or editorials or letters).pt.) (3372)

10 9 and (aged or elder\$2 or frail or geriatr* or geront* or nonagen* or octogen* or older or senior or septuagen* or sexagen*).ti,ab,kf. (273)

11 limit 10 to yr="2018 -Current" (121)

[KQ 2 ClinicalTrials.gov](https://www.clinicaltrials.gov)

KQ 3

Ovid MEDLINE ALL 1946 to May 11, 2023

Date searched: May 12, 2023

1 (Axis, Cervical Vertebra/ or Odontoid Process/ or Cervical Atlas/) and (exp Diagnostic Imaging/ or imaging.hw. or dg.fs.) (3102)

2 (Axis, Cervical Vertebra/ or Odontoid Process/ or Cervical Atlas/) and ((abus* or accident* or break* or broken or collision* or crash\$2 or dislocat* or dissociat* or faceplant* or fall\$1 or falling or fascia* or fracture* or hyperextension\$1 or hyper-extension\$1 or injur* or ligament* or longus or "motor vehicle" or muscle\$1 or musculature or posttrauma* or traffic or tissue or trauma* or wound*) and (CT or imaging or MDCT or MRI or noncontrast or non-contrast or radiograph* or resonance or scan\$1 or scanning or tomograph* or x-ray\$1)).ti,ab,kf. (1170)

3 (atlantoaxial or atlanto* or atlas or ((axial or axis) and (cervical or neck)) or C1 or "C1/2" or C2 or CCJ or CVJ or craniocervical or cranio-cervical or craniovertebr* or cranio-vertebr* or hangman\$2 or odontoid\$2 or epitrochysis) and (accident* or break* or broken or collision* or crash\$2 or dislocat* or dissociat* or faceplant* or fall\$1 or falling or fascia* or fracture* or hyperextension\$1 or hyper-extension\$1 or injur* or ligament* or longus or "motor vehicle" or muscle\$1 or musculature or posttrauma* or traffic or tissue or trauma* or wound*) and (CT or imaging or MDCT or MRI or noncontrast or non-contrast or radiograph* or resonance or scan\$1 or scanning or tomograph* or x-ray\$1).ti,ab,kf. (10106)

4 or/1-3 (12143)

5 4 not ((exp Animals/ not Humans/) or (animal model* or bitch\$2 or bovine or canine or capra or cat or cats or cattle or cow\$1 or dog\$1 or equine or ewe\$1 or feline or goat\$1 or hamster\$1 or horse\$1 or invertebrate\$1 or macaque\$1 or mare\$1 or mice or monkey\$1 or mouse or murine or nonhuman or non-human or ovine or pig or pigs or porcine or primate\$1 or rabbit\$1 or rat\$1 or rattus or rhesus or rodent* or sheep or simian or sow\$1 or vertebrate\$1 or zebrafish).ti. or (ankle\$1 or arthritis or cataract\$1 or coronary or "chron's" or elbow\$1 or femur\$1 or femoral or fibula\$1 or hip or humerus or humeral or inguinal* or knee or knees or lumbar or meniscus or meniscal or nontrauma* or patella\$1 or pelvis or pelvic or radial or radius or sacroiliac or scoliosis or syndrome or talus or tarso* or thoracolumbar or tibia\$1 or ulna1 or vitrectom*).ti. or ("case report" or comment or commentary).ti. or (case reports or comments or editorials or letters).pt.) (6818)

6 limit 5 to ("all infant (birth to 23 months)" or "all child (0 to 18 years)" or "newborn infant (birth to 1 month)" or "infant (1 to 23 months)" or "preschool child (2 to 5 years)" or "child (6 to 12 years)" or "adolescent (13 to 18 years)") (1571)

7 5 and (adolescen* or baby or babies or boys or child* or girls or infancy or infant\$1 or juvenile\$1 or neonat* or newborn\$1 or paediat* or pediat* or prepubescen* or preschool* or pubescen* or school* or student\$1 or teen* or toddler\$1).ti,ab,kf. (762)

- 8 or/6-7 (1741)
- 9 limit 8 to english language (1537)
- 10 limit 9 to yr="2020 -Current" (208)
- 11 (meta-analysis or review or systematic review).pt. or (meta-anal* or metaanal* or ((evidence or review or scoping or systematic or umbrella) adj3 (review or synthesis))).ti. (3518367)
- 12 and/10-11 (18)
- 13 limit 9 to yr="2018 -Current" (356)
- 14 (controlled clinical trial or randomized controlled trial).pt. or (control or controls or controlled or placebo\$1 or random* or trial*).ti,ab,kf. (5804248)
- 15 and/13-14 (60)
- 16 15 not 12 (59)
- 17 Cohort Studies/ or Comparative Study/ or Follow-Up Studies/ or Longitudinal Studies/ or Prospective Studies/ or Retrospective Studies/ or (cohort\$1 or ((comparative or evaluation) adj3 study) or follow-up or longitudinal\$2 or prospective\$2 or retrospective\$2).ti,kf. (4241300)
- 18 and/13,17 (159)
- 19 18 not (12 or 16) (127)

Ovid EBM Reviews - Cochrane Central Register of Controlled Trials April 2023

Date searched: May 12, 2023

- 1 (Axis, Cervical Vertebra/ or Odontoid Process/ or Cervical Atlas/) and (exp Diagnostic Imaging/ or imaging.hw. or dg.fs.) (13)
- 2 (Axis, Cervical Vertebra/ or Odontoid Process/ or Cervical Atlas/) and ((abus* or accident* or break* or broken or collision* or crash\$2 or dislocat* or dissociat* or faceplant* or fall\$1 or falling or fascia* or fracture* or hyperextension\$1 or hyper-extension\$1 or injur* or ligament* or longus or "motor vehicle" or muscle\$1 or musculature or posttrauma* or traffic or tissue or trauma* or wound*) and (CT or imaging or MDCT or MRI or noncontrast or non-contrast or radiograph* or resonance or scan\$1 or scanning or tomograph* or x-ray\$1)).ti,ab,kf. (4)
- 3 (atlantoaxial or atlanto* or atlas or ((axial or axis) and (cervical or neck)) or C1 or "C1/2" or C2 or CCJ or CVJ or craniocervical or cranio-cervical or craniovertebr* or cranio-vertebr* or hangman\$2 or odontoid\$2 or epitrochysis) and (accident* or break* or broken or collision* or crash\$2 or dislocat* or dissociat* or faceplant* or fall\$1 or falling or fascia* or fracture* or hyperextension\$1 or hyper-extension\$1 or injur* or ligament* or longus or "motor vehicle" or muscle\$1 or musculature or posttrauma* or traffic or tissue or trauma* or wound*) and (CT or imaging or MDCT or MRI or noncontrast or non-contrast or radiograph* or resonance or scan\$1 or scanning or tomograph* or x-ray\$1).ti,ab,kf. (427)
- 4 or/1-3 (436)
- 5 4 not ((exp Animals/ not Humans/) or (animal model* or bitch\$2 or bovine or canine or capra or cat or cats or cattle or cow\$1 or dog\$1 or equine or ewe\$1 or feline or goat\$1 or hamster\$1 or horse\$1 or invertebrate\$1 or macaque\$1 or mare\$1 or mice or monkey\$1 or mouse or murine or nonhuman or non-human or ovine or pig or pigs or porcine or primate\$1 or rabbit\$1 or rat\$1 or rattus or rhesus or rodent* or sheep or simian or sow\$1 or vertebrate\$1 or zebrafish).ti. or (ankle\$1 or arthritis or cataract\$1 or coronary or "chron's" or elbow\$1 or femur\$1 or femoral or fibula\$1 or hip or humerus or humeral or inguinal* or knee or knees or lumbar or meniscus or meniscal or nontrauma* or patella\$1 or pelvis or pelvic or radial or radius or sacroiliac or scoliosis or syndrome or talus or tarso* or thoracolumbar or tibia\$1 or ulna\$1 or vitrectom*).ti. or ("case report" or comment or commentary).ti. or (case reports or comments or editorials or letters).pt.) (338)
- 6 5 and (adolescen* or baby or babies or boys or child* or girls or infancy or infant\$1 or juvenile\$1 or neonat* or newborn\$1 or paediat* or pediat* or prepubescen* or preschool* or pubescen* or school* or student\$1 or teen* or toddler\$1).ti,ab,kf. (35)

7 limit 6 to yr="2018 -Current" (18)

[KQ 3 ClinicalTrials.gov](https://www.clinicaltrials.gov)

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, if a partner organization would use this evidence review to influence practice, and if the topic supports a priority area of AHRQ or the Department of Health and Human Services.

Appendix B. Selection Criteria Assessment

| Selection Criteria | Assessment |
|---|---|
| 1. Appropriateness | |
| 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 U.S.? | 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. |
| 2. Importance | |
| 2a. Represents a significant disease burden; large proportion of the population | Yes. Worldwide, between 250,00 and 500,00 people suffer acute injuries of the cervical spine and spinal cord each year. ¹ |
| 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. Worldwide, between 250,00 and 500,00 people suffer acute injuries of the cervical spine and spinal cord each year. ¹ Hospital costs in the United States exceeded \$10 billion in 2015 and averaged more than \$50,000 per admission. ³⁰ |
| 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. Hospital costs in the United States exceeded \$10 billion in 2015 and averaged more than \$50,000 per admission. ³⁰ |
| 3. Desirability of a New Evidence Review/Absence of Duplication | |
| 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 systematic reviews that cover the scope of the nomination. |
| 4. Impact of a New Evidence Review | |
| 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 Congress of Neurological Surgeons has determined that, due to the time that has elapsed since release of the 2013 guidelines, the guidelines should be updated within the next two years. |
| 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 Congress of Neurological Surgeons has stated that some new drugs and imaging techniques have emerged over the last ten years. |
| 5. Primary Research | |
| 5. Effectively utilizes existing research and knowledge by considering: - Adequacy (type and volume) of research for conducting a systematic review - Newly available evidence (particularly for updates or new technologies) | We found the following number of primary studies per key question: <i>KQ1- 10</i> <i>KQ2-8</i> <i>KQ3-0</i> We reviewed the entire search yield for each of the key questions. The estimated size of a new review is limited. |
| 6. Value | |
| 6a. The proposed topic exists within a clinical, consumer, or policy-making context that is amenable to evidence-based change and | Yes, changes to guidelines can be made based on evidence, and AHRQ supports efforts to increase the quality of evidence-based healthcare |

| | |
|---|--|
| supports a priority of AHRQ or Department of Health and Human Services | guidelines. |
| 6b. Identified partner who will use the systematic review to influence practice (such as a guideline or recommendation) | Yes. The Congress of Neurological Surgeons has determined that, due to the time that has elapsed since release of the 2013 guidelines, the guidelines should be updated within the next two years. |

Abbreviations: AHRQ=Agency for Healthcare Research and Quality.