

Appendix

Pediatric Cervical Spine Study Group - Survey 1 - October 2016

1. Please enter your name:

2. Please enter your email:

3. How many years have you been practicing?

- <5 years
- 5-10 years
- 10-20 years
- >20 years

4. Please enter your specialty:

- Pediatric Emergency Medicine
- Pediatric General Surgery
- Pediatric Neurosurgery
- Pediatric Orthopedics
- Pediatric Radiology
- Other (please specify)

5. Please list your hospital affiliation:

6. Is your hospital a certified Level I Trauma Center?

- Yes
- No

7. What type of institution is your hospital?

- Academic Children's Hospital on a medical campus or attached to an adult center
- Academic affiliated free-standing Children's Hospital
- Community-based Children's Hospital
- Other (please specify)

8. Who has primary responsibility for clearing the cervical spine for trauma patients?

- Emergency Room Physicians
- General Surgery/Trauma Surgery

- Orthopedic Surgery
 - Neurosurgery
 - A combination of services on a rotating basis
9. Who sees spine consults?
- General Surgery/Trauma Surgery
 - Orthopedic Surgery
 - Neurosurgery
 - A combination of services on a rotating basis
10. Who operates on spinal trauma patients?
- Orthopedic Surgery
 - Neurosurgery
 - A team consisting of both orthopedics and neurosurgery
11. If necessary, where does the operation take place?
- At your institution
 - Patient is transferred to another institution
12. Does your emergency department have 24-hour access to a CT and MRI scanner?
- CT scanner only
 - MRI scanner only
 - Both CT and MRI scanners
 - Neither
13. What imaging modalities are used primarily for cervical spine clearance?
- Plain radiography (AP, lateral, open mouth odontoid views)
 - Plain radiography (lateral cervical spine view) in combination with a CT head scan including Occiput, C1, C2
 - CT of entire cervical spine
 - MRI of entire cervical spine
14. What is the minimum age in which a child can have cervical spine clearance without using imaging?
- <1 year old
 - <2 years old
 - <3 years old
 - <4 years old

- <5 years old
- <6 years old
- <7 years old

15. What is the minimum age of the child in which your radiology department can easily obtain a quality, complete AP and lateral x-ray of the cervical spine?

- <1 year old
- <2 years old
- <3 years old
- <4 years old
- <5 years old
- <6 years old
- <7 years old

QUESTIONS REGARDING PANEL DISCUSSION APPROACH

This project aims to develop a consensus statement regarding best practices for clearance of the cervical spine in pediatric trauma patients. In order to do so, the objective of this panel discussion is to develop a clearance protocol that will:

- a.) Address radiation safety by minimizing its use to effectively clear patients with possible cervical spine injuries
- b.) Enable the physician to detect all cervical spine injuries
- c.) Enable the physician to detect all serious cervical spine injuries
- d.) Reduce the amount of time that a patient is in a cervical collar
- e.) Efficiently use hospital and personnel resources to minimize cost to patient, patient's families, hospital, and insurance companies
- f.) Be universally applied to all departments and specialties

Please answer Questions #16 and #17 while referring to the above list of objectives.

16. Would you like to add another objective? If so, please specify.

17. Would you like to remove 1 of the listed objectives? If so, please list which one.

We propose to approach the discussion by addressing four groups of patients:

- 1.) Verbal, developmentally normal child who has a potential cervical spine injury
- 2.) Unresponsive, developmentally normal child who cannot be reliably examined due to intoxication, intubation, traumatic brain injury, etc.
- 3.) Infant/Toddler (under the age of 3 years) with potential cervical spine injuries
- 4.) Child who previous underwent cervical-spine surgery and child with conditions predisposing to cervical spine injury

For each group of patients, a consensus statement regarding best practices for clearance will be determined.

Please answer Questions #18, #19, and #20 while referring to the approach listed above as well as to the description of the four patient groupings.

18. Do you agree or disagree with this approach?

- Agree
- Disagree

19. Would you like to see another group of patients addressed? If so, please specify.

20. Would you like to change the description of a group of patients or do you have other suggestions?

Pediatric Cervical Spine Study Group - Survey 2 - December 2016

Definition of Terms and Establishment of Basic Premises

For Questions #1-7, please indicate whether you agree or disagree with each of the following statements while also providing any input if applicable. Please note that the terms defined in this section are used throughout this survey using the definition as it is listed here.

1. The purpose of a pediatric cervical spine clearance protocol is to identify significant cervical spine injuries in children who have sustained blunt trauma. The ideal protocol identifies all significant injuries, minimizes radiation exposure to the child, and permits removal of a rigid cervical collar, or other method of cervical spine immobilization, as expeditiously as possible.

- Agree
- Disagree

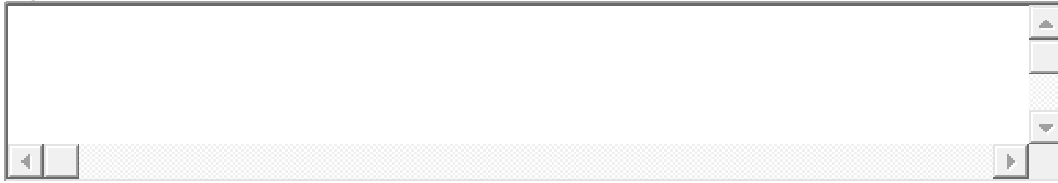
Please add any input, if applicable

2. Pediatric cervical spine clearance is the process by which a child with a suspected cervical spine injury undergoes clinical evaluation (history and physical exam) and, in select cases, is evaluated by diagnostic imaging to determine that a cervical spine injury has not occurred. A complete history includes, among other details, a determination of the mechanism of injury when possible.

- Agree
- Disagree
- Please add any input if applicable

3. Clinical clearance of the cervical spine is the determination that a child with a suspected cervical spine injury does not have a cervical spine injury after clinical evaluation (history and physical exam) alone without adjunct diagnostic imaging.


- Agree
- Disagree
- Please add any input if applicable



4. Diagnostic imaging includes plain radiographs (AP/lateral cervical spine views at minimum), CT scan of the cervical spine, and MRI of the cervical spine. Dynamic cervical spine imaging includes flexion-extension lateral cervical spine plain radiographs, flexion-extension CT scan of the cervical spine, and flexion-extension MRI of the cervical spine.

- Agree
- Disagree

Please add any input if applicable



5. Interpretation of diagnostic imaging of the pediatric cervical spine, and final determination of findings, is performed by personnel with advanced training and expertise in the imaging of pediatric spine conditions. Personnel generally qualified to perform this task are Radiologists, Neurosurgeons and Orthopedic Surgeons.

- Agree
- Disagree

Please add any input if applicable



6. Pediatric cervical spine clearance is the responsibility of physicians with expertise in evaluating a child with a suspected cervical spine injury. Personnel generally qualified to perform this task include Emergency Department physicians, General and Trauma surgeons, Neurosurgeons and Orthopedic Surgeons.

- Agree
- Disagree

Please add any input if applicable



7. A “Spine Consult Service” is defined as a subspecialist or team of specialists with advanced training and expertise in the care of pediatric spine conditions. This term generally refers to teams composed of Neurosurgeons and Orthopedic Surgeons.

- Agree
- Disagree
- Please add any input if applicable

8. In constructing an algorithm (see examples) for pediatric cervical spine clearance, the first consideration when initiating a clearance protocol is:

(Please note that two, separate examples of pediatric cervical spine clearance algorithms will be sent to you via a separate email. The examples were provided by Julie C. Leonard, MD, MPH, and Douglas L. Brockmeyer, MD, who are members of the Pediatric Cervical Spine Study Group and Panel)

- Mental status
- Mechanism of injury
- Age of the patient

9. At your institution, clinical clearance of the cervical spine without adjunct diagnostic imaging is done routinely for children of all ages after an appropriate clinical evaluation.

- Agree
- Disagree

10. At your institution, clinical clearance of children younger than 3 years of age is done only by the spine consult service, as defined by Question #7.

- Agree
- Disagree

11. At your institution, clearance of the cervical spine in children younger than 3 years of age (child abuse not suspected) is only done after adjunct diagnostic imaging is interpreted as negative.

- Agree
- Disagree

12. Your institution’s pediatric cervical spine clearance protocol relies upon the NEXUS criteria to accomplish clinical clearance.

- Yes
- No

13. Your institution's pediatric cervical spine clearance protocol relies upon the Canadian Cervical Spine Rules to accomplish clinical clearance.

- Yes
- No

14. A child regardless of age with a Glasgow Coma Scale (GCS) of 15 (includes pediatric GCS for nonverbal child) is considered to have normal mental status.

- Agree
- Disagree

15. A child regardless of age with a GCS < 15 or who is under the influence of alcohol or drugs that alter the sensorium is considered to have an altered mental status.

- Agree
- Disagree

16. A child with altered mental status based on GCS evaluation cannot undergo clinical clearance of the cervical spine.

- Agree
- Disagree

17. A nonverbal child younger than 3 years of age with a GCS of 15 cannot be reliably examined to allow clinical clearance of the cervical spine.

- Agree
- Disagree

18. A nonverbal child with a developmental disability with a GCS of 15 cannot be reliably examined to allow clinical clearance of the cervical spine.

- Agree
- Disagree

19. Please list any other methods used by your institution to define normal mental status:

Please respond to the following statement for the conditions listed in Questions #20-24.

Risk factors for cervical spine injury determined during the clinical evaluation (history) have been defined in the literature. Clinical clearance alone without adjunct diagnostic imaging CANNOT be performed if the child exhibits the following:

20. Altered mental status or evidence of altered sensorium for alcohol or drugs.

- Agree
- Disagree

21. A history of a loss of consciousness but a normal GCS score during evaluation.

- Agree
- Disagree
22. A history of a focal sensory abnormality or motor deficit but a normal examination during evaluation.

- Agree
- Disagree

23. A complaint of neck pain.

- Agree
- Disagree

24. Torticollis or abnormal head posture or position.

- Agree
- Disagree

Please respond to the following statement for the mechanisms and conditions listed in Questions #25- #38.

Mechanisms and conditions that are defined as high-risk for cervical spine injury, as defined in the literature, are determined in the clinical evaluation (history). In my institution, clinical clearance without adjunct diagnostic imaging in children, even when the exam is normal, is NOT performed if the following mechanisms and conditions are identified:

25. Diving accident.

- Agree
- Disagree

26. Fall from height greater than the height of the patient.

- Agree
- Disagree

27. Hanging from a noose or ligature around the neck.

- Agree
- Disagree

28. Pedestrian or bicyclist struck by motor vehicle.

- Agree
- Disagree

29. Recreational vehicle accident (ex. ATV, motor bike).

- Agree
- Disagree

30. Motor vehicle crash at high speed (> 35mph).

- Agree

- Disagree
31. Motor vehicle crash in which another passenger was killed.
- Agree
- Disagree
32. Motor vehicle crash in which the patient was unrestrained.
- Agree
- Disagree
33. Motor vehicle crash in which the patient was ejected.
- Agree
- Disagree
34. Motor vehicle crash in which the passenger compartment was intruded upon.
- Agree
- Disagree
35. Axial load to the head or “clothesline” injury (head contacted from the front).
- Agree
- Disagree
36. Child abuse.
- Agree
- Disagree
37. Pre-existing or known associated cervical spine abnormalities/conditions such as Klippel-Feil syndrome, Down syndrome, previous surgery, etc.
- Agree
- Disagree
38. If the child’s mental status is normal, no signs or symptoms of cervical spine injury are present and the exam is normal, clinical clearance, as defined by Question #3, is done regardless of mechanism or pre-existing conditions.
- Agree
- Disagree

Please respond to the following statement for the conditions listed in Questions #39- #44.

Risk factors for cervical spine injury determined during the clinical evaluation (physical exam) have been defined in the literature. Clinical clearance alone without adjunct diagnostic imaging CANNOT be performed if the child exhibits the following:

39. Posterior midline tenderness.

- Agree
- Disagree

40. Tenderness anywhere along the cervical spine.

Agree

Disagree

41. Visible external injury such as bruising or abrasion on the cervical spine.

Agree

Disagree

42. Visible or known significant injury to chest, abdomen or pelvis.

Agree

Disagree

43. A distracting injury such as a femur fracture.

Agree

Disagree

44. Limited active cervical range of motion.

Agree

Disagree

45. In the child age 3 or older with a normal mental status, no history of signs or symptoms suggestive of a cervical spine injury and a normal exam, clinical clearance without adjunct diagnostic imaging CAN be done regardless of the mechanism of injury.

Agree

Disagree

46. In the child age 3 or older with a normal mental status, no history of signs or symptoms suggestive of cervical spine injury and a normal exam, clinical clearance without adjunct diagnostic imaging CANNOT be done if the child has a high-energy mechanism or a mechanism that has been defined as a high risk for cervical spine injury.

Agree

Disagree

47. In the child younger than age 3 with a normal mental status, no history of signs or symptoms suggestive of a cervical spine injury and a normal exam, clinical clearance without adjunct diagnostic imaging CAN be done regardless of the mechanism of injury.

Agree

Disagree

48. In the child younger than age 3 with a normal mental status, no history of signs or symptoms suggestive of a cervical spine injury and a normal exam, clinical clearance without adjunct diagnostic imaging CANNOT be done if the child has a high-energy mechanism or a mechanism that has been defined as a high risk for cervical spine injury.

Agree

Disagree

49. For the child 3 years of age and older with normal mental status who cannot undergo clinical clearance after a clinical evaluation, the first imaging modality to consider for further evaluation is:

Plain radiographs of the cervical spine

CT scan of the cervical spine

MRI of the cervical spine

Other (please specify)

50. For the child younger than 3 years of age with normal mental status who cannot undergo clinical clearance after a clinical evaluation, the first imaging modality to consider for further evaluation is:

Plain radiographs of the cervical spine

CT scan of the cervical spine

MRI of the cervical spine

Other (please specify)

51. For the children described in Questions #49 and #50, if the primary imaging modality is negative, the next best step is:

Remove the collar, unless it is used for comfort to manage a suspected minor soft tissue injury, and schedule reevaluation in 5-7 days

Perform flexion-extension radiographs or other further diagnostic imaging acutely

Consult the Spine Service

Other (please specify)

52. Imaging adequate to evaluate the cervical spine by plain radiography includes AP/lateral views that visualize the cervical spine to the lower endplate of C7.

Agree

Disagree

53. Imaging adequate to evaluate the cervical spine by plain radiography includes AP/lateral/odontoid views that visualize the cervical spine to the lower endplate of C7.

Agree

Disagree

54. The odontoid can be reliably obtained in children who are OLDER than:

3 years of age

- 4 years of age
- Other (please specify)

55. The child with a suspected cervical spine injury, regardless of age, who has an altered mental status or evidence of altered sensorium from alcohol or drugs cannot undergo clinical clearance of the cervical spine without adjunct diagnostic imaging.

- Agree
- Disagree

56. The child with a suspected cervical spine injury, regardless of age, who has an altered mental status or evidence of altered sensorium from alcohol or drugs and cannot undergo clinical clearance of the cervical spine without adjunct diagnostic imaging must be immobilized in a cervical collar until further evaluation is completed.

- Agree
- Disagree

57. For the child 3 years of age and older with a suspected cervical spine injury who has an altered mental status or evidence of altered sensorium from alcohol or drugs or cannot undergo clinical clearance of the cervical spine based on the clinical evaluation for any reason, the first imaging modality to consider is:

- Plain radiographs of the cervical spine
- Plain radiographs of the cervical spine, unless the child is having a head CT as part of the diagnostic imaging, in which case a CT of the cervical spine is added
- CT of the cervical spine whether or not the child is having a head CT
- MRI of the cervical spine
- Other (please specify)

58. For the child described in Question #57, if the primary imaging modality is negative, the next best step is:

- CT of the cervical spine if the primary modality to evaluate the child was plain radiographs
- MRI of the cervical spine if the primary modality to evaluate the child was plain radiographs and/or CT of the cervical spine
- Dynamic imaging studies such as flexion-extension radiographs, CT or MRI

If you chose the third option, please list which modality

59. For the child younger than 3 years of age with a suspected cervical spine injury who has an altered mental status or evidence of altered sensorium from alcohol or drugs or cannot undergo

clinical clearance of the cervical spine based on the clinical evaluation for any reason, the first imaging modality to consider is:

- Plain radiographs of the cervical spine
- Plain radiographs of the cervical spine, unless the child is having a head CT as part of the diagnostic imaging, in which case a CT of the cervical spine is added
- CT of the cervical spine whether or not the child is having a head CT
- MRI of the cervical spine
- Other (please specify)

60. For the child described in Question #59, if the primary imaging modality is negative, the next best step is:

- CT of the cervical spine if the primary modality to evaluate the child was plain radiographs
- MRI of the cervical spine if the primary modality to evaluate the child was plain radiographs
- Dynamic imaging studies such as flexion-extension radiographs, CT or MRI

If you chose the third option, please indicate which modality

61. Clearance of the cervical spine in the child with an altered mental status who has no expectation of a neurological recovery that will permit a reliable clinical exam should have an MRI before cervical immobilization can be discontinued.

- Agree
- Disagree

62. Clearance of the cervical spine in the child with an altered mental status who has no expectation of a neurological recovery that will permit a reliable clinical exam should have a dynamic imaging study of the cervical spine before cervical immobilization can be discontinued.

- Agree
- Disagree

63. The best way to evaluate injury to the craniocervical junction for potential injury is:

- MRI of the cervical spine
- CT of the cervical spine, taking into account the condyle-C1 interval (CCI) on the images
- Dynamic imaging studies
- Other (please specify)

64. The child younger than 3 years of age who is being evaluated for child abuse should have an MRI of the cervical spine as part of the surveillance for injury regardless of the clinical evaluation.

Agree

Disagree

65. Clinical clearance of the cervical spine of the child with a significant developmental disability is possible but information about the type of disability, the child's baseline intellectual function and pre-injury behaviors must be obtained and evaluated prior to discontinuing cervical immobilization.

Agree

Disagree

66. Clinical clearance of the cervical spine of the child with a significant developmental disability is not possible without adjunct diagnostic imaging.


Agree

Disagree

Pediatric Cervical Spine Study Group - Survey 3 - April 2017


- 1) In a child with GCS of 14 or 15 with normal plain radiographs, a normal physical exam, and midline neck pain/tenderness, any of the three management options are acceptable to clear potential ligamentous injury:
- a.) Placement of a rigid cervical collar with re-evaluation in 1-2 weeks
 - b.) Spine service consultation
 - c.) Obtain adequate flexion/extension radiographs (defined as $\geq 30^\circ$ flexion and $\geq 30^\circ$ extension)
- Agree
- Disagree

Please provide comments/opinions




- 2) In a child with GCS of 14 or 15 with normal plain radiographs, a normal physical exam, and midline neck pain/tenderness, adequate flexion/extension radiographs (defined as $\geq 30^\circ$ flexion and $\geq 30^\circ$ extension) is an OPTION to clear potential ligamentous injury.
- Agree
- Disagree

Please provide comments/opinions



- 3) In a child with GCS of 14 or 15 with normal plain radiographs, a normal physical exam, midline neck pain/tenderness AND adequate flexion/extension radiographs (defined as $\geq 30^\circ$ flexion and $\geq 30^\circ$ extension), the cervical spine is cleared.
- Agree
- Disagree

Please provide comments/opinions



- 4) In a child with normal plain radiographs, a normal physical exam, and persistent midline neck pain/tenderness, any of the three management options are acceptable to clear potential ligamentous injury:
- a. Continuation of a rigid cervical collar with re-evaluation after another 1-2 weeks
 - b. Spine service consultation
 - c. Obtain adequate flexion/extension radiographs (defined as $\geq 30^\circ$ flexion and $\geq 30^\circ$ extension)
- Agree
- Disagree

Please provide comments/opinions



- 5) In a child with normal plain radiographs, a normal physical exam, and persistent midline neck pain/tenderness, adequate flexion/extension radiographs (defined as $\geq 30^\circ$ flexion and $\geq 30^\circ$ extension) is an OPTION to clear potential ligamentous injury.
- Agree
- Disagree

Please provide comments/opinions



- 6) In a child with normal plain radiographs, a normal physical exam, persistent midline neck pain/tenderness AND adequate flexion/extension radiographs (defined as $\geq 30^\circ$ flexion and $\geq 30^\circ$ extension), the cervical spine is cleared.
- Agree

Disagree

Please provide comments/opinions

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7) In a child with $GCS \leq 8$ and a reasonable suspicion of cervical spine injury and a normal CT, adequate flexion/extension radiographs (defined as $\geq 30^\circ$ flexion and $\geq 30^\circ$ extension) using fluoroscopy is an OPTION to clear potential ligamentous injury.

Agree
 Disagree

Please provide comments/opinions

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8) In a child with $GCS \leq 8$ and a reasonable suspicion of cervical spine injury and a normal CT, and an MRI that is inconclusive to rule out ligamentous injury, adequate flexion/extension radiographs (defined as $\geq 30^\circ$ flexion and $\geq 30^\circ$ extension) using fluoroscopy is an OPTION to clear potential ligamentous injury.

Agree
 Disagree

Please provide comments/opinions

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9) In a child with $GCS \leq 8$ and a reasonable suspicion of cervical spine injury, a normal CT, and adequate flexion/extension radiographs (defined as $\geq 30^\circ$ flexion and $\geq 30^\circ$ extension) using fluoroscopy, the cervical spine is cleared.

Agree
 Disagree

Please provide comments/opinions

