Guidelines for the In-Hospital Management of the C-Spine in Children with Trauma
“Think Neck”

Cervical Spine (C-Spine) Immobilisation
All children who have sustained major trauma should be risk-assessed using the Canadian C-Spine Rule (CCR); however, the child’s developmental stage should be taken into account:

- the child is at high risk if they have one of the following:
  - dangerous mechanism of injury (fall from a height of greater than 1 metre or 5 steps, axial load to the head – for example diving, high-speed motor vehicle collision, rollover motor accident, ejection from a motor vehicle, accident involving motorised recreational vehicles, bicycle collision, horse riding accidents)
  - paraesthesia in the upper or lower limbs

- the child is at low risk if they have at least one of the following low-risk factors:
  - involved in a minor rear-end motor vehicle collision
  - comfortable in a sitting position
  - ambulatory at any time since the injury
  - no midline cervical spine tenderness
  - delayed onset of neck pain

- the child remains at low risk if they are:
  - unable to actively rotate their neck 45 degrees to the left and right (the range of the neck can only be assessed safely if the child is at low risk and there are no high-risk factors).

- the child has no risk if they:
  - have one of the above low-risk factors and
  - are able to actively rotate their neck 45 degrees to the left and right.

Full in-line spinal immobilisation should be carried out in children at high or low risk of cervical spine injury.

Those with no risk do not need full in-line spinal immobilisation; however, the following additional risk factors should be considered and C-spine immobilisation maintained if:

- GCS less than 13 on initial assessment
- pre-existing spinal pathology
- predisposing condition that makes the C-spine more vulnerable to injury (eg. Down’s syndrome, rheumatoid arthritis, Ehlers-Danlos, osteogenesis imperfecta, skeletal dysplasia involving the spine, etc)
- any other clinical suspicion of cervical spine injury including but not limited to suspicious mechanism of injury, injuries to clavicle, suspected fracture in another region of the spine, abnormal neurological symptoms (paraesthesia, weakness or numbness).

Cervical spine protection may be achieved by manual in-line immobilisation, hard collar (may not be suitable for under 5 yrs), blocks and tapes or by a visual prompt such as soft collar or forehead sticker in unconscious patients. Manual in-line C-spine immobilisation should be
maintained for airway intubation, collar fitting and any other interventions that may cause passive movement of the neck.

Children who have reduced GCS (whether primary or medication induced) are at particular risk during transfer, log rolling and care requiring manipulation (eg. tracheostomy toilet).

Appropriate spinal protection should be used:
- during transfer & log Rolling
- if the intubated child is not muscle relaxed
- if the intubated child is on a muscle relaxant holiday

The standard flat pack hard collar should be changed to a properly fitted Miami J collar as soon as possible after admission to avoid pressure sores.

C-Spine clearance:

C-spine collars can cause pressure sores and may increase ICP. They may not fit well in under 5s or children who are distressed or agitated - other measures will be needed to protect the C-Spine (eg. head blocks). The need for continued C-spine immobilisation should be assessed at the earliest opportunity and reviewed not less than every 24hrs after admission.

All clinicians with appropriate training will be able to clear the c-spine in the majority of children.

NICE advocates the use of the Canadian C-Spine rule to assess and initially manage C-spine injuries. Additionally, the National Emergency X-Radiography Utilization Study (NEXUS) is the only clinical decision rule that has been validated in children <16 and helps assess the need for imaging in children with suspected C-spine injury in blunt trauma.

[See attached algorithm – Appendix 1]

For non-verbal children, especially those under 3 years old, and children who intubated, C-spine clearance can be difficult. [See attached algorithm – Appendix 2]

All imaging should be reviewed by a clinician trained in their interpretation, with a provisional written radiology report made available within 1h for CT / MRI scans.

All children with proven spinal injury with or without imaging changes should be discussed with the specialist spinal team who will give guidance on definitive management. If spinal clearance is not achieved after the above steps are complete they will be able to advise on further management.

In addition to a thorough record of the primary and secondary surveys, all children (over 4 years old) with suspected spinal cord injury should have an ASIA chart (American Spinal Injury Association) completed as soon as possible in the emergency department, and record:
- vital capacity (age >7)
- ability to cough
**Children with head injury** and the following risk factors should have a CT scan of the whole C-spine within the hour:

- GCS less than 13 on initial assessment.
- The patient has been intubated.
- Focal peripheral neurological signs.
- Paraesthesia in the upper or lower limbs.
- A definitive diagnosis of cervical spine injury is needed urgently (for example, before surgery).
- The patient is having other body areas scanned for head injury or multi-region trauma.
- There is strong clinical suspicion of injury despite normal X-rays.
- Plain X-rays are technically difficult or inadequate.
- Plain X-rays identify a significant bony injury.

Those with none of the above risk factors but have neck pain or tenderness should follow the algorithm for C-spine clearance (Appendix 1).

**All decisions regarding clearance and management of the C-spine should be documented.**
Flow chart for the In-Hospital Management of the C-Spine in Children with Trauma

“Think Neck”

**A&E Resus**

- It should be recognised that all children with major trauma\(^1\) have a potential injury to the neck
- In-line immobilisation or collar (may not be appropriate in under 5s) and blocks should be used during initial resuscitation\(^3\)
- Spinal clearance can be carried out and documented by an appropriately qualified doctor.\(^2,4-7\)
- Children are at risk of spinal injury even if the plain C-spine XR is normal. In high risk patients (history of injury, injuries to head, clavicle, thoracic spine, reduced GCS, suspicion of peripheral neurological deficit) protection must continue even if the XR is normal and opinion urgently sought from the specialist spine team\(^1\)

**Theatre/ Definitive care (including PICU)**

- Children at risk in whom spinal clearance cannot happen during resuscitation should continue to be managed as if presumed to have a spinal injury\(^7\)
- Appropriate\(^7\) precautions for spinal protection should be taken during transfers, intubation, positioning in theatre or on the ward. Special care is required in unconscious/anaesthetised patients.
- An appropriately sized hard collar should be used unless the child is under five or the case is unsuitable\(^1\).
- If a collar cannot be used an alternative visual prompt (blocks and tape, soft collar or forehead alert) is needed to ensure all team members are easily alerted to the need for precautions to be taken to protect the C-spine.
- Spinal clearance should be carried out as soon as possible\(^7\) but may be difficult in the unconscious child and cases of concern should have all imaging reviewed by a paediatric radiologist and can be discussed with the appropriate specialist\(^7\)
- The need for spinal clearance should be reviewed no less that every 24hrs by an appropriately qualified person who will see and assess the patient. The outcome of every assessment should be documented.\(^3\)
- MRI is the investigation of choice for the exclusion of spinal injury in children\(^2\) because of the higher incidence of spinal cord injury without radiological abnormality (SCIWORA)

**References:**

\(^1\) “Candidate” Major Trauma patients as defined in Service specifications for Major Trauma Centres, NHS Commissioning Board, 2013

\(^2\) Spinal injury: assessment and initial management. NICE guideline NG41 (published Feb 2016) [http://www.nice.org.uk/guidance/ng41]

\(^3\) APLS©


\(^7\) See accompanying guidelines

Karen Daly, Clinical Lead for Children’s Major Trauma / Andrea Yeo, Paediatric Orthopaedics

May 2016