Summary of recommendations

Recommendations are newly drafted by the Spine SAG, unless indicated otherwise.

I. INITIAL MANAGEMENT

KMQ-1. What are the key considerations in the initial assessment and management of patients with suspected injury to the spine (without suspected neurological deficit)?

A. On arrival at the scene of the incident, use a prioritizing sequence to assess people with suspected trauma, for example <C>ABCDE:

- Catastrophic hemorrhage
- Airway with in-line spinal immobilization
- Breathing
- Circulation
- Disability (neurological)
- Exposure and environment. [Adopted from NICE]

B. On arrival in the emergency department:

- Maintain airway, high flow O_2
- Maintain c-spine protection (Aspen collar)
- Prioritize concomitant injuries based on ATLS protocols
- Call Trauma Services for triage of polytrauma patients

C. Spinal immobilization of all trauma patients with a cervical spine or spinal cord injury or with a mechanism of injury having the potential to cause cervical spinal injury is recommended. [Adopted from AANS/CNS]

D. At all stages of the assessment protect the person's cervical spine with a collar or manual in-line spinal immobilization during any movement or interventions. Avoid moving the remainder of the spine. [Adopted from NICE with modifications]

E. A protocol for protection of the entire spine must be in place in all hospitals managing trauma patients at risk of spinal injury. This protection must be maintained from arrival until appropriate examination or investigations are completed and either the spine is cleared of injury, or the patient is transferred for definitive care. [Adopted from BOA 2015 with modification]

F. Assess the person for spinal injury, initially taking into account the factors listed below. Check if the person:

- Has any significant distracting injuries (see Rationale-i.)
- Is under the influence of drugs or alcohol
- Is confused or uncooperative
- Has a reduced level of consciousness
- Has any spinal pain
- Has any hand or foot weakness (motor assessment)
- Has altered or absent sensation in the hands or feet (sensory assessment)
- Has priapism (unconscious or exposed male)
- Has a history of past spinal problems, including previous spinal surgery or conditions that predispose to instability of the spine.

Carry out full in-line immobilization if any of the above factors are present or if this assessment cannot be done. [Adopted from NICE]

G. Assess whether the person is at high, low or no risk for cervical spine injury using the Canadian C-spine rule as follows:

- the person is at high risk if they have at least one of the following high-risk factors:
  - age 65 years or older
  - 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 motorized recreational vehicles, bicycle collision, horse riding accidents)
  - paresthesia in the upper or lower limbs
- the person 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 person 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 person is at low risk and there are no high-risk factors).
- the person 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. [Adopted from NICE] (See Rationale ii. for the benefits of applying the Canadian C-Spine Rule to clear the cervical spine)

H. Assess the person with suspected thoracic or lumbosacral spine injury using these factors:

- age 65 years or older and reported pain in the thoracic or lumbosacral spine
- dangerous mechanism of injury (fall from a height of greater than 3 metres, axial load to the head or base of the spine — for example falls landing on feet or buttocks, high-speed motor vehicle collision, rollover motor accident, lap belt restraint only, ejection from a motor vehicle, accident involving motorized recreational vehicles, bicycle collision, horse riding accidents)
- pre-existing spinal pathology, or known or at risk of osteoporosis — for example steroid use
- suspected spinal fracture in another region of the spine
- abnormal neurological symptoms (paresthesia or weakness or numbness)
- on examination:
  - abnormal neurological signs (motor or sensory deficit)
  - new deformity or bony midline tenderness (on palpation)
  - bony midline tenderness (on percussion)
  - midline or spinal pain (on coughing) [Adopted from NICE with modification]

I. Carry out or maintain full in-line spinal immobilization if:

- a high-risk factor for cervical spine injury is identified and indicated by the Canadian C-spine rule (see Appendix A for the full criteria)
- a low-risk factor for cervical spine injury is identified and indicated by the Canadian C-spine rule (see Appendix A) and the person is unable to actively rotate their neck 45 degrees left and right
- indicated by one or more of the factors listed in Recommendation H above (or see Appendix B). (See Rationale ii. for the benefits of applying the Canadian C-Spine Rule to clear the cervical spine.) [Adopted from NICE]

J. When carrying out full in-line spinal immobilization in adults, manually stabilize the head with the spine in-line using the following stepwise approach:

- Fit an appropriately sized semi-rigid collar unless contraindicated by:
  - a compromised airway
  - known spinal deformities, such as ankylosing spondylitis (in these cases keep the spine in the person's current position).
- Reassess the airway after applying the collar.
- Place and secure the person on a scoop stretcher.
- Secure the person with head blocks and tape, ideally in a vacuum mattress. [Adopted from NICE]

K. Discontinue use of spinal boards as soon as possible after trauma assessment. Spine boards are only to be used for extrication of injured patients. Prolonged use of spinal boards should be avoided, particularly in those with suspected or confirmed neurologic deficit.

L. Assess pain regularly in people with spinal injury using a pain assessment scale suitable for the patient's age, developmental stage and cognitive function. Continue to assess pain in hospital using the same pain assessment scale that was used in the pre-hospital setting. [Adopted from NICE]

M. The American Spinal Injury Association (ASIA) international standards for neurological and functional classification of spinal cord injury are recommended as the preferred neurological examination tool for clinicians involved in the assessment and care of acute spinal cord injury patients. (See Appendix C) [Adopted from AANS/CNS]

N. Clinical evaluation of injured patients must include appropriate and repeated examination of the nervous system which should be recorded in the medical notes on an ASIA chart in keeping with the International Standards for Neurological Classification in Spinal Cord Injury (SNCSCI). [Adopted from BOA 2012 with modification]

O. Documentation of the neurological status must be made in all at-risk patients; any sign of spinal cord injury mandates a teleconference with on-call Spine Service at VGH. A clinical examination of the whole spine should be documented. [Adopted from BOA 2015 with modification]

KMQ-2. What are the key considerations in the initial assessment and management of patients with suspected injury to the spine and with suspected neurological deficit?

A. On arrival in the ED:

- Maintain airway, high flow O_2
- Maintain c-spine protection (Aspen collar)
- Prioritize concomitant injuries based on ATLS protocols
- Call Trauma Services for triage of polytrauma patients

B. Spine boards are only to be used for extrication of injured patients. Prolonged use of spinal boards should be avoided, particularly in those with suspected or confirmed neurologic deficit.

C. In cases of a suspected or confirmed spinal cord injury with neurological deficit, insertion of an arterial line and management of the mean arterial pressure (MAP) is recommended. MAP goal should be 85 to 90 mmHg. Preferred IV vasopressor is norepinephrine. Euvolemic status prior to initiation and titration of vasopressors must be measured. (See Rationale iii. for the optimal MAP in acute spinal injury, and Rationale ix. for complications in hemodynamic management of acute spinal cord injury.)

D. If there is considerable difficulty in maintaining MAP and there is a potential of serious adverse effects from vasopressors, drop MAP goal to 80 mmHg after consultation with Spine Service at VGH.

E. Intravenous steroids are not recommended in the acute management of traumatic spinal cord injury.

F. The American Spinal Injury Association (ASIA) international standards for neurological and functional classification of spinal cord injury are recommended as the preferred neurological examination tool for clinicians involved in the assessment and care of acute spinal cord injury patients. (See Appendix C) [Adopted from AANS/CNS]

G. Clinical evaluation of injured patients must include appropriate and repeated examination of the nervous system which should be recorded in the medical notes on an ASIA chart in keeping with the International Standards for Neurological Classification in Spinal Cord Injury (SNCSCI). [Adopted from BOA 2012 with modification]

H. Documentation of the neurological status must be made in all at-risk patients; any sign of spinal cord injury mandates a teleconference with on-call Spine Service at VGH. A clinical examination of the whole spine should be documented. [Adopted from BOA 2015 with modification]

KMQ-3. What is the appropriate management of the cervical spine in awake, evaluable and symptomatic patients?

A. When there is no immediate CT access on site and:

- If the patient has definite neurologic deficit with cord injury, call Spine Service at VGH immediately.
- If the patient has definite neurologic deficit without cord injury, call regional Spine Service immediately to consult a spine surgeon and call PTN to initiate transfer to higher level of care.
- If the patient has no neurologic deficit but there is a high suspicion of spinal fracture based on the Canadian C-Spine Rule (see Appendix A), conduct plain film X-rays and then call regional Spine Service for a consult and PTN for transfer to higher level of care. (See Rationale ii. for the benefits of applying the Canadian C-Spine Rule to clear the cervical spine.)

B. In awake and alert patients with normal CT results with unreliable clinical exam, maintain cervical spine precautions and consult a spine surgeon at regional Spine Services immediately.

C. In awake and alert patients with abnormal CT results and high index of suspicion for spinal cord injury (i.e., due to mechanism of injury or midline tenderness), maintain cervical spine precautions and consult a spine surgeon at Spine Services at VGH immediately.

KMQ-4. What is the appropriate management of the cervical spine in obtunded or otherwise unevaluable patients?

A. In the obtunded or unevaluable patient with a normal high-quality CT, the following recommendations should be considered:

- Call PTN to discuss case with regional Spine Service on call,
- Continue cervical immobilization until evaluable and asymptomatic, or until transfer, or
- Discontinue cervical immobilization following a normal MRI study obtained within 48 hours of injury. [Adopted from AANS/CNS with modification]

B. When there is no immediate CT access on site and:

- If the patient has definite neurologic deficit with cord injury, call Spine Service at VGH immediately.
- If the patient has definite neurologic deficit without cord injury, call regional Spine Service immediately to consult a spine surgeon and call PTN to initiate transfer to higher level of care.
- If the patient has no neurologic deficit but there is a high suspicion of spinal fracture based on the Canadian C-Spine Rule (see Appendix A), conduct plain film x-rays and then call regional Spine Service for a consult and PTN for transfer to higher level of care. (See Rationale ii. for the benefits of applying the Canadian C-Spine Rule to clear the cervical spine.)

II. DIAGNOSTIC IMAGING — WITHOUT NEUROLOGIC DEFICIT

KMQ-5. What are the indications for imaging of the cervical spine in alert and evaluable patients? What is the imaging modality of choice in these patients?

A. Perform CT if imaging for cervical spine injury is indicated by the Canadian C-spine rule (see Appendix A for full criteria, and see Rationale ii. for the benefits of the Canadian C-spine Rule). [Adopted from NICE]

B. All patients in whom C-spine injury is suspected (see Appendix A) must have radiographic evaluation. This applies to patients with pain or tenderness, patients with neurologic deficit, patients with altered mental status, and patients with distracting injury. [Adopted from EAST 2009] (See Rationale-i. for what constitutes distracting injuries, and Rationale ii. for the benefits of applying the Canadian C-Spine Rule to clear the cervical spine.)

C. Radiographic evaluation of the cervical spine is not recommended in the patient who:

- is awake and asymptomatic,
- is without neck pain or tenderness
- has a normal neurological examination
- is without an injury detracting from an accurate evaluation, and
- is able to complete a functional range of motion examination.

Discontinuance of cervical immobilization for these patients is recommended without cervical spinal imaging. [Adopted from AANS/CNS]

D. For the cervical spine, the appropriate imaging standard is a thin slice (1–3 mm) helical CT scan from the base of the skull to at least T2 with both sagittal and coronal reconstructions. [New SAG recommendation adapted from EAST 2009]

E. Where a CT scan is available, plain radiographs contribute no additional information and should not be obtained. (See Rationale iv. for a comparison of CT and plain radiography in detecting cervical spine injuries.) [Adopted from EAST 2009 with modification]

F. If high-quality CT imaging is not available, a 3-view cervical spine series (anteroposterior, lateral, and odontoid views) is recommended. This should be supplemented with CT (when it becomes available), if necessary, to further define areas that are suspicious or not well visualized on the plain cervical X-rays. [Adopted from AANS/CNS]

KMQ-6. What are the indications for imaging of the cervical spine in obtunded or unevaluable patients? What is the imaging modality of choice in these patients?

A. If it is anticipated a patient will remain unconscious, unassessable or unreliable for clinical examination for more than 48 hours, radiological spinal clearance imaging should be undertaken. It is recommended that this cervical spine CT scan be undertaken as a routine with the first CT brain scan in all head-injured patients who have an altered level of consciousness. [Adopted from BOA 2015]

B. For the cervical spine, the appropriate standard is a thin slice (1–3 mm) helical CT scan from the base of the skull to at least T2 with both sagittal and coronal reconstructions. It is recommended that this cervical spine CT scan be undertaken as a routine with the first CT brain scan in all head-injured patients who have an altered level of consciousness. [Adopted from BOA 2015]

C. Where a CT scan is available, plain radiographs contribute no additional information and should not be obtained. (See Rationale iv. for a comparison of CT and plain radiography in detecting cervical spine injuries.) [Adopted from EAST 2009 with modification]

D. If high-quality CT imaging is not available, a 3-view cervical spine series (anteroposterior, lateral, and odontoid views) is recommended. This should be supplemented with CT (when it becomes available) if necessary to further define areas that are suspicious or not well visualized on the plain cervical X-rays. [Adopted from AANS/CNS]

E. In patients in whom there is a high clinical suspicion of spinal injury yet have a normal high-quality CT imaging study, it is recommended that further patient management be discussed via PTN with the VGH Spine Service on call. It is recommended that, where possible, all spinal imaging performed be officially reported on by the radiologist on call. [Adopted from AANS/CNS with modification]

F. In the obtunded or unevaluable patient with or without a normal high-quality CT, the routine use of dynamic imaging (i.e., Flexion extension views) is not recommended. [Adopted from AANS/CNS with modification]

KMQ-7. What are the indications for imaging of the thoraco-lumbar spine in patients with suspected spinal injury? What is the imaging modality of choice in these patients?

A. Patients with back pain, TL-spine tenderness on examination, neurologic deficits referable to the TL-spine, altered mental status, intoxication, distracting injuries, or known or suspected high-energy mechanisms should be screened for TL-spine injury with a CT scan. (See Appendix B for full assessment criteria, Rationale i. for what constitutes distracting injuries, and Rationale vi. for the effectiveness of clinical examination in ruling out thoraco-lumbar spine injuries.) [Adopted from EAST 2012 with modification]

B. When imaging is deemed necessary, we recommend performing a CT scan (1–3 mm slices) as the first line investigation. Perform X-rays only if CT is not available. (See Rationale v. for a comparison of CT and plain radiography in detecting thoraco-lumbar spine injuries.) [Adapted from EAST 2012]

C. In blunt trauma patients with a known or suspected injury is confirmed anywhere in the spinal column, conduct thorough evaluation of the entire spine using CT owing to a high incidence of spinal injury at multiple levels within this population. [Adopted from EAST 2012 with modification]

D. If a person with suspected spinal column injury has Whole Body CT, carry out multiplanar reformatting to show all the thoracic and lumbosacral regions with sagittal and coronal reformats. [Adopted from NICE]

E. Patients without complaints of TL-spine pain that have normal mental status, as well as normal neurological and physical examinations may be excluded from TL-spine injury by clinical examination alone, without radiographic imaging, provided that there is no suspicion of high-energy mechanism or intoxication with alcohol or drugs. [Adopted from EAST 2012]

KMQ-8. Under what circumstances would it be appropriate to transfer the patient to another site without definitive care for a CT or MRI?

A. When there is no immediate CT access on site and if the patient has no neurologic deficit but there is a high suspicion of spinal fracture based on the Canadian C-Spine Rule (see Appendix A), conduct plain film X-rays and then call regional Spine Service for consult and PTN for transfer to higher level of care. (See Rationale ii. for the benefits of applying the Canadian C-Spine Rule to clear the cervical spine.)

III. DIAGNOSTIC IMAGING — WITH SUSPECTED OR CONFIRMED NEUROLOGIC DEFICIT

KMQ-9. What are the indications for imaging of the cervical spine in alert and evaluable patients with suspected or confirmed neurological deficit? What is the imaging modality of choice in these patients?

A. Perform CT if imaging for cervical spine injury is indicated by the Canadian C-spine rule (see Appendix A), including patients with pain or tenderness, patients with neurologic deficit, patients with altered mental status, and patients with distracting injury. (See Rationale i. for what constitutes distracting injuries, and Rationale ii. for the benefits of applying the Canadian C-Spine Rule to clear the cervical spine.) [Adopted from NICE and EAST 2009]

B. Radiographic evaluation of the cervical spine is not recommended in the awake, asymptomatic patient who is without neck pain or tenderness, who has a normal neurological examination, is without an injury detracting from an accurate evaluation, and who is able to complete a functional range of motion examination. Discontinuance of cervical immobilization for these patients is recommended without cervical spinal imaging. [Adopted from EAST 2009 and AANS/CNS]

C. For the cervical spine, the appropriate standard is a thin slice (1–3 mm) helical CT scan from the base of the skull to at least T1 with both sagittal and coronal reconstructions. Extending that scan to T4/5 overcomes the difficulties of imaging the upper thoracic spine. It is recommended that this cervical spine CT scan be undertaken as a routine with the first CT brain scan in all head-injured patients who have an altered level of consciousness. [Adopted from EAST 2009 and BOA 2015 with modification]

D. Where a CT scan is available, plain radiographs contribute no additional information and should not be obtained. (See Rationale iv. for a comparison of CT and plain radiography in detecting cervical spine injuries.) [Adopted from EAST 2009 and AANS/CNS with modification]

E. If high-quality CT imaging is not available, a 3-view cervical spine series (anteroposterior, lateral, and odontoid views) is recommended. This should be supplemented with CT (when it becomes available) if necessary to further define areas that are suspicious or not well visualized on the plain cervical X-rays. [Adopted from AANS/CNS]

KMQ-10. What are the indications for imaging of the cervical spine in obtunded or unevaluable patients? What is the imaging modality of choice in these patients?

A. If it is anticipated a patient will remain unconscious, unassessable or unreliable for clinical examination for more than 48 hours, radiological spinal clearance imaging should be undertaken. It is recommended that this cervical spine CT scan be undertaken as a routine with the first CT brain scan in all head-injured patients who have an altered level of consciousness. [Adopted from BOA 2015]

B. For the cervical spine, the appropriate standard is a thin slice (1–3 mm) helical CT scan from the base of the skull to at least T1 with both sagittal and coronal reconstructions; extending that scan to T4/5 overcomes the difficulties of imaging the upper thoracic spine. It is recommended that this cervical spine CT scan be undertaken as a routine with the first CT brain scan in all head-injured patients who have an altered level of consciousness. [Adopted from EAST 2009 and BOA 2015 with modification]

C. Where a CT scan is available, plain radiographs contribute no additional information and should not be obtained. (See Rationale iv. for a comparison of CT and plain radiography in detecting cervical spine injuries.) [Adopted from EAST 2009 with modification]

D. If high-quality CT imaging is not available, a 3-view cervical spine series (anteroposterior, lateral, and odontoid views) is recommended. This should be supplemented with CT (when it becomes available) if necessary to further define areas that are suspicious or not well visualized on the plain cervical x-rays. [Adopted from AANS/CNS]

E. In patients with a normal high-quality CT imaging result in whom there is a high clinical suspicion of spinal cord injury, a discussion with the VGH Spine Services via PTN is recommended for further patient management. It is recommended that, where possible, all spinal imaging performed be officially reported by the radiologist on call. [Adopted from AANS/CNS with modification]

F. In the obtunded or unevaluable patient with a normal high-quality CT, the routine use of dynamic imaging is not recommended. [Adopted from AANS/CNS with modification]

KMQ-11. What are the indications for imaging of the thoraco-lumbar spine in patients with suspected spinal injury and with neurologic deficit? What is the imaging modality of choice in these patients?

A. Perform CT as the first-line investigation for people with suspected spinal column injury without abnormal neurological signs or symptoms in the thoracic or lumbosacral regions. This includes patients with back pain, TL-spine tenderness on examination, neurologic deficits referable to the TL-spine, altered mental status, intoxication, distracting injuries, or known or suspected high-energy mechanisms. [Adapted from EAST 2012] (See Appendix A and Appendix B for assessment criteria) (See Rationale i. for what constitutes distracting injuries, and Rationale vi. for the effectiveness of clinical examination in ruling out thoraco-lumbar spine injuries.)

B. In blunt trauma patients with a known or suspected injury is confirmed anywhere in the spinal column, conduct thorough evaluation of the entire spine using CT owing to a high incidence of spinal injury at multiple levels within this population. [Adopted from EAST 2012 with modification]

C. Patients without complaints of TL-spine pain that have normal mental status, as well as normal neurological and physical examinations may be excluded from TL-spine injury by clinical examination alone, without radiographic imaging, provided that there is no suspicion of high-energy mechanism or intoxication with alcohol or drugs. [Adopted from EAST 2012]

D. When imaging is deemed necessary, CT scans with sagittal and coronal reformats should be used to screen for and diagnose, as CT scans are superior to plain films in identifying TL-spine fractures. (See Rationale v. for a comparison of CT and plain radiography in detecting thoraco-lumbar spine injuries.) [Adopted from EAST 2012 and NICE]

KMQ-12. Under what circumstances would it be appropriate to transfer the patient to another site without definitive care for a CT or MRI?

A. When there is no immediate CT access on site and

- If the patient has definite neurologic deficit with cord injury, call VGH Spine Service immediately to consult a spine surgeon and call PTN to initiate transfer to higher level of care.
- If the patient has definite neurologic deficit without cord injury, call regional Spine Service immediately to consult a spine surgeon and call PTN to initiate transfer to higher level of care.

IV. TRANSFER TO HIGHER LEVEL OF CARE

KMQ-13. What are the indications for and timing of transfer of patients with confirmed or suspected spinal injury without neurological deficit to a higher-level trauma centre?

A. For patients who have a suspected or confirmed spinal injury with neurological deficit or spinal cord injury, immediately contact the spinal surgeon on call at VGH through PTN. [Adopted from NICE with modification]

B. When there is no immediate CT access on site and:

- If the patient has definite neurologic deficit with cord injury, call Spine Service at VGH immediately to consult a spine surgeon and call PTN to initiate transfer to higher level of care.
- If the patient has definite neurologic deficit without cord injury, call regional Spine Service immediately to consult a spine surgeon and call PTN to initiate transfer to higher level of care.
- If the patient has no neurologic deficit but there is a high suspicion of spinal fracture based on the Canadian C-Spine Rule (see Appendix A), conduct plain film x-rays and then call regional Spine Service for a consult and PTN for transfer to higher level of care. (See Rationale ii. for the benefits of applying the Canadian C-Spine Rule to clear the cervical spine.)

C. In acute spinal cord injury, patients should undergo surgical decompression within 24 hours of arrival at ED. (See Rationale vii. for optimal timing of surgical decompression)

D. Complete the Spine Checklist prior to initiating transfer and have available the following information for the call:

- CT results (if available)
- ASIA scores (see Appendix C)
- Basic neurologic exam
- Age
- Mechanism of injury
- Vital signs
- Rectal exam
- Associated injuries
- High risk for intubation:
  - The elderly
  - C5 injury or higher, regardless of age
  - T1 injury or higher in patients age >60 years
  - Chronic obstructive pulmonary disease (COPD)
  - Morbidly obese
  - Vital capacity <15 mL/kg
  - Increasing pCO_2
  - Maximum respiratory pressure of <20 cm of water

KMQ-14. What are the indications for and timing of transfer of patients with confirmed or suspected spinal injury with suspected or confirmed neurological deficit to a higher-level trauma centre?

A. In acute spinal cord injury, patients should undergo surgical decompression within 24 hours of arrival at ED. (See Rationale vii. for optimal timing of surgical decompression)

B. Complete the Spine Checklist prior to initiating transfer and have available the following information for the call:

- CT results (if available)
- ASIA scores (see Appendix C)
- Basic neurologic exam
- Age
- Mechanism of injury
- Vital signs
- Rectal exam
- Associated injuries
- High risk for intubation:
  - The elderly
  - C5 injury or higher, regardless of age
  - T1 injury or higher in patients age >60 years
  - Chronic obstructive pulmonary disease (COPD)
  - Morbidly obese
  - Vital capacity <15 mL/kg
  - Increasing pCO_2
  - Maximum respiratory pressure of <20 cm of water

KMQ-15. What are the indications for local (remote) management of stable spinal fractures (fractures not requiring transfer)?

A. Stable fractures, without neurological deficit, may be treated remotely, and not be transferred. This should be done on a case-by-case basis, after discussion with the regional spine surgeon on call via PTN. Adequate resources for local treatment and supervision must be available and confirmed. Complete the Spine Checklist below prior to initiating transfer and have available the following information for the PTN call:

- CT results (if available)
- ASIA scores (see Appendix C)
- Basic neurologic exam
- Age
- Mechanism of injury
- Vital signs
- Rectal exam
- Associated injuries
- High risk for intubation:
  - The elderly
  - C5 injury or higher, regardless of age
  - T1 injury or higher in patients age >60 years
  - Chronic obstructive pulmonary disease (COPD)
  - Morbidly obese
  - Vital capacity <15 mL/kg
  - Increasing pCO_2
  - Maximum respiratory pressure of <20 cm of water

V. PRE-TRANSFER CARE

KMQ-16. What is the optimal pre-transfer management of patients with suspected or confirmed spinal cord injury without neurological deficit?

A. Adequate pain management is recommended to control pain in the acute phase after spinal injury. [Adopted from NICE with modification]

B. For people with spinal injury use intravenous morphine as the first-line analgesic and adjust the dose as needed to achieve adequate pain relief. [Adopted from NICE]

KMQ-17. What is the optimal pre-transfer management and preparation of patients with suspected or confirmed spinal injury with neurological deficit?

A. All receiving facilities should have province-wide written guidelines for the immediate management of a person with spinal cord injury and these should have been agreed upon with the linked spinal cord injury centre. [Adopted from NICE with modification]

B. Do not use the following medications, aimed at providing neuroprotection and prevention of secondary deterioration, in the acute stage after acute traumatic spinal cord injury:

- Methylprednisolone
- Nimodipine
- Naloxone. [Adopted from NICE and AANS/CNS]

C. Adequate pain management is recommended to control pain in the acute phase after spinal injury. [Adopted from NICE with modification]

D. For people with spinal injury use intravenous morphine as the first-line analgesic and adjust the dose as needed to achieve adequate pain relief. [Adopted from NICE]

E. Management of patients with an acute cervical spinal cord injury in an intensive care unit or similar monitored setting is recommended. [Adopted from AANS/CCNS]

F. Use of cardiac, hemodynamic, and respiratory monitoring devices to detect cardiovascular dysfunction and respiratory insufficiency in patients following acute spinal cord injury is recommended. [Adopted from AANS/CCNS]

G. Correction of hypotension in spinal cord injury (systolic blood pressure, 90 mmHg) when possible and as soon as possible is recommended. [Adopted from AANS/CCNS]

H. Maintenance of mean arterial blood pressure (MAP) between 85 and 90 mmHg for the first 7 days following an acute spinal cord injury is recommended. If there is considerable difficulty in maintaining MAP and there is a potential of serious adverse effects from vasopressors, drop MAP goal to 80 mmHg after consultation with the VGH Spine Service. [Adopted from AANS/CCNS with modification]

I. Consider the need for intubation for transfer in patients with high risk for respiratory failure, such as:

- The elderly
- C5 injury or higher, regardless of age
- T1 injury or higher in patients age >60 years
- Chronic obstructive pulmonary disease (COPD)
- Morbidly obese
- Vital capacity <15 mL/kg
- Increasing pCO_2
- Maximum respiratory pressure of <20 cm of water

VI. LOCAL MANAGEMENT OF STABLE SPINAL FRACTURES

KMQ-18. What is the appropriate local (remote) management of stable spinal fractures (not requiring transfer)?

A. Stable fractures, without neurological deficit, may be treated remotely, and not be transferred. This should be done on a case by case basis, after discussion with the regional spine surgeon on call via PTN. Adequate resources for local treatment and supervision must be available and confirmed. Complete the Spine Checklist below prior to initiating transfer and have available the following information for the PTN call:

- CT results (if available)
- ASIA scores (see Appendix C)
- Basic neurologic exam
- Age
- Mechanism of injury
- Vital signs
- Rectal exam
- Associated injuries
- High risk for intubation:
  - The elderly
  - C5 injury or higher, regardless of age
  - T1 injury or higher in patients age >60 years
  - Chronic obstructive pulmonary disease (COPD)
  - Morbidly obese
  - Vital capacity <15 mL/kg
  - Increasing pCO_2
  - Maximum respiratory pressure of <20 cm of water