Spinal Immobilization Guidelines for Remote & Austere Environments

Figure. Spinal immobilization guidelines for remote and austere environments. CCR, Canadian C-spine Rule; MOI, mechanism of injury; NEXUS, National Emergency X-Radiography Utilization Study; PRN, as needed.

mattresses and sleeping bags). If a head-injured patient requires full spinal immobilization, consider using a soft or heavily padded cervical collar to reduce the potential for the ongoing development of increased intracranial pressure. Using the “spine as a long bone” strategy may permit selective immobilization of the patient’s spine and prevent some iatrogenic injuries during prolonged transport. At the patient’s request, a padded cervical collar (eg, padded SAM splint) or thoracic/lumbar support (eg, internal frame backpack with hip belt) can be used if it increases patient comfort during a self-evacuation. There is no research that establishes a timeline for the development of injuries caused by “prolonged” spine immobilization on a well-padded litter or backboard. Pressure sores can begin to develop in a few hours with some patients on a hard surface (eg, unpadded backboard).

The risk-benefit assessment described in the algorithm is both subjective and objective, and the final result will depend on the training and skills of the rescuers. The proposed algorithm significantly lowers the immobilization threshold in an austere environment with an otherwise ambulatory patient who has no neurological deficit but who has failed either the NEXUS or CCR examination, and when self-evacuation would significantly lower the overall risk for the patient or rescuers during the evacuation. Unlike the WMS algorithm, this algorithm maintains the reliability of the CCR guidelines and NEXUS criteria while significantly reducing the immobilization threshold when the risk warrants it. For those already familiar with the CCR and NEXUS guidelines, the algorithm is easy to remember and teach.

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In Reply to Spine Protection in the Austere Environment

To the Editor:

The letter to the editor from Dr Zafren et al raises some excellent points worthy of an expanded conversation. We welcome the opportunity to respond in the hope that this discussion will provide added clarity to our Wilderness Medical Society Practice Guidelines for Spine Immobilization in the Austere Environment.¹

Manual cervical traction is the standard technique for moving patients with known spine trauma in the hospital

setting. That is done in an effort to keep the spine in the anatomic position and to prevent distortion of the spine that might occur otherwise. Traction is often used for stabilization and reduction of unstable spine injuries. In the monitored hospital setting, up to 150 pounds of cervical traction has been used safely in the reduction of unstable spine injuries.² Although it is true that traction can be dangerous in case of a grossly unstable spine injury, and therefore excessive traction should be avoided in the unmonitored setting, light to moderate traction when returning a cervical spine to the anatomic position and transferring a patient is preferred.

We are unaware of any evidence that would preclude transportation in the lateral decubitus position. Spine-injured patients are frequently placed in the lateral decubitus position when hospitalized without ill effect.

For those readers unfamiliar with guidelines, it is important to understand what they are meant to be. A systematic review is a review article that summarizes the best available evidence on a given topic. Guidelines combine the best available evidence with expert opinion in an effort to provide clinical recommendations when the evidence itself fails to adequately do so. Our manuscript aims to provide 3 “levels” of guidance: 1) to review the pertinent evidence for each topic; 2) to provide recommendations that are either implicit in the evidence or combined with expert opinion to be clinically meaningful; and 3) to provide a sample algorithm that represents an attempt to combine the above in a practical format for general field practice across a broad range of disciplines.

The algorithm is not meant to provide the definitive answer to spine care in the field. It is meant as a template open to modification by skilled and knowledgeable providers. As Dr Zafren et al point out, the evidence fails to support the use of immobilization altogether, and in that light, there is no need for the algorithm. We realize, however, that the levels of evidence currently available, although likely accurate, are not high level. That, combined with the fact that many will consider the very notion of discarding immobilization in its entirety “heresy,” makes our algorithm a reasonable transition to a new paradigm while allowing (and, it is hoped, promoting) further study to improve our understanding of spine injury, spinal protection, and the quality of evidence on which to base further recommendations.

We have already received several suggestions for changing our algorithm, none of which materially or substantially change the spirit of the existing one. No algorithm will address every clinical situation or be accepted by every medical provider, and situational use

will likely differ. Adaptations to the algorithm that might improve the fit to alpine rescue may adversely affect the fit to swift water or cave rescue, and so forth. Such adaptations are encouraged at the field level when implemented by practiced and knowledgeable providers.

Regarding the National Emergency X-Radiography Utilization Study (NEXUS) criteria and Canadian C-spine Rule (CCR), these have been “validated” but not “optimized” (particularly for the dangerous rescue environment). A meta-analysis on clearance of the asymptomatic cervical spine showed a sensitivity of 98.1% and a negative predictive value of 99.8%; however, specificity was 35.4% and positive predictive value a mere 3.7%.³ The good news is that we are not missing those with cervical spine injury; however, we are still immobilizing far too many unnecessarily (96.4%). How many of the true positives were serious injuries is not documented but, no doubt, these represent an even smaller subgroup.

The 3 most controversial (or least validated) components of the algorithm would be these: 1) discarding mechanism of action as a stand-alone qualifier; 2) requiring significant spine pain or tenderness at a level $\geq 7/10$; and 3) requiring voluntary flexion, extension, and rotation 45 degrees in each plane. We believe the rationale for mechanism of action was discussed adequately in the manuscript. Requiring significant spine pain or tenderness at a level $\geq 7/10$ was chosen in an attempt to separate inconsequential spine injury (muscular, fracture of spinous/transverse process, and so forth). Regarding range of motion testing, we do concede that 30 degrees of motion in all planes is more appropriate for the thoracolumbar spine, and the future algorithm will be changed accordingly. The premise is based on the well-validated use of flexion/extension cervical spine radiographs to clear a cervical spine. For years (before magnetic resonance imaging), this procedure served as the “gold standard” used to definitively clear the cervical spine, based on the knowledge that a standard lateral c-spine radiograph may appear normal in the presence of significant soft tissue injury with underlying spine instability. Flexion/extension cervical spine radiographs have been routinely performed under the direct volition of the patient under the premise that an alert patient will not cause themselves neurologic harm in the presence of an injury with the capacity to do so. To our knowledge, no adverse patient reaction has been reported after many years of use. The ability to perform the maneuver, and the extent to which range of motion should occur, should be left entirely to the alert patient; pain alone should not be used as a disqualifier to interrupt the maneuver.

Regarding the letter by Mr Nicolazzo, we believe the same responses apply, particularly regarding mechanism of injury (MOI) and NEXUS/CCR. Unfortunately, the inclusion of some subjectivity in this type of algorithm is inescapable, whether referring to MOI, tenderness, or interpretation of pain. Risk calculation, too, is highly subjective and will likely vary substantially by individual and team providers and scene. We believe that adding this to the algorithm is likely to contribute confusion. Additionally, he has added other patient assessment steps and principles not related directly to the spine and a “new” concept of the “spine as a long bone principle.” The principle is not a bad one, but does interject a new concept. Those concerns aside, we believe his algorithm represents a good example of how the template provided in our guidelines can be modified and adapted to better satisfy the needs of individual operations without changing the spirit of the principles.

We thank Dr Zafren et al and Mr Nicolazzo for their thoughtful comments and hope that the expanded conversation is helpful to our readers.

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The Incidence of Acute Mountain Sickness Among Passengers Traveling Across the Tibetan Plateau by Train

To the Editor:

The number of tourists visiting high altitude areas has increased in recent years, and they face the threat of acute mountain sickness (AMS). The reported prevalence of AMS varies between 15% and 80% depending on the speed of ascent, absolute altitude reached, and individual susceptibility.^{1–3} We had a chance to evaluate the incidence of AMS among passengers who were first exposed to high altitude by taking the Tibetan railway train. A summary is presented here.

High altitude areas are defined as areas at an altitude ≥ 2500 m above the mean sea level. Volunteer passengers aged 18 to 70 years old traveling by trains at high altitude (Tibetan Plateau) and low altitude (Urumqi railway) were selected consecutively. The inclusion criteria were passengers who were capable of finishing the questionnaires independently by themselves, who were low altitude dwellers, and who had not been to the high altitude area within 1 year. The exclusion criteria were permanent natives of high altitudes and passengers with preexisting symptoms of organ dysfunction due to severe respiratory, cardiovascular, renal, and cerebral diseases. The subjects' demographic information and AMS symptoms were collected by questionnaires. Physical parameters, including respiratory rate, blood pressure, peripheral capillary oxygen saturation (SpO₂), heart rate, and heart function (New York Heart Association functional class), were recorded for the scheduled altitude and time. The 4 selected stations at high altitude were Lanzhou (altitude 1600 m to 1800 m), Xining (2500 m to 3100 m), Naqu (4347 m to 5072 m), and Lhasa (4141 m to 3671 m), where the trains had running times of 12 hours, 20.5 hours, 38.5 hours, and 42.5 hours, respectively. Three railway stations in the control group were Yinchuan