World Water Safety

INTERNATIONAL LIFE SAVING FEDERATION

Gemeenteplein 26 – 3010 Leuven – Belgium
Tel: +32 (0)16 896060
E-mail: ils.hq@telenet.be - Web: www.ilsf.org

MEDICAL POSITION STATEMENT - MPS 21

SPINAL INJURY MANAGEMENT

Note: Medical Position Statements are intended only for trained lifeguards with a duty to respond.

PLAIN LANGUAGE SUMMARY

This statement provides a framework to enable lifeguards to effectively implement spinal motion restriction in aquatic settings. The basic principles are: recognise an aquatic incident involving a suspected spinal injury; assess safety; ask to call for help and activate the Emergency Medical Services (EMS); perform a rescue using relevant spinal motion restriction techniques, if needed, based on any relevant signs and/or symptoms.

BACKGROUND

Owing to the relative rarity of traumatic spinal cord injury (TSCI), the existing literature consists only of low-quality evidence. This position statement is based on a recently published expert consensus specific to the prehospital aquatic environment.[1]

A TSCI is defined as damage to the spinal cord following external physical impact.[2] The primary injury is caused by direct mechanical injury from the traumatic impact.[3,4] Secondary injury may be caused by ongoing bleeding or swelling at the injured site and surrounding area. The effect of incorrect handling of the injured person is speculated to be associated with worsening of the injury, but evidence to support this association is lacking. However, it is recommended that lifeguards be competent in managing in-water traumatic spinal cord injuries.[5–9] "Spinal motion restriction" (SMR) is the procedure used on an individual with suspected TSCI to reduce spinal movement, with or without adjuncts or devices, which aims to reduce the risk of secondary injury by handling with care. "Extrication" is transporting the person with suspected in-water TSCI from the water to the land using the appropriate SMR measures.

Approximately 10% of all TSCI are aquatic-related.[10–16] Diving into shallow water poses the most significant risk, but several mechanisms resulting in axial loading combined with hyperflexion-extension may cause spinal cord injury.[3,4] Most incidents occur in young, healthy males under the age of 30 years. Other risk factors include alcohol consumption, lack of warning signs or depth indicators, and no lifeguard on duty.[17] The cervical spine is most commonly injured (particularly C-5 and C-6).[11,18] The rate of neurological injuries, including paralysis and sensory deficits following in-water TSCI, is high (22-90%).[3,10,11,15,16]

STATEMENT

Consensus-based guidelines published in 2024[1] are conceptualised in Figure 1 and elaborated in Figure 2. The complete list of consensus-based recommendations, including their rationale, is available from the open-access publication.

The overall management principles of the person with a suspected TSCI are outlined below and are elaborated in the following sections:

1. Recognise aquatic incident involving a suspected spinal injury
2. Assess safety
3. Ask to call for help and activate the EMS
4. Perform rescue using relevant spinal motion restriction techniques, if needed/possible, based on any relevant signs/symptoms

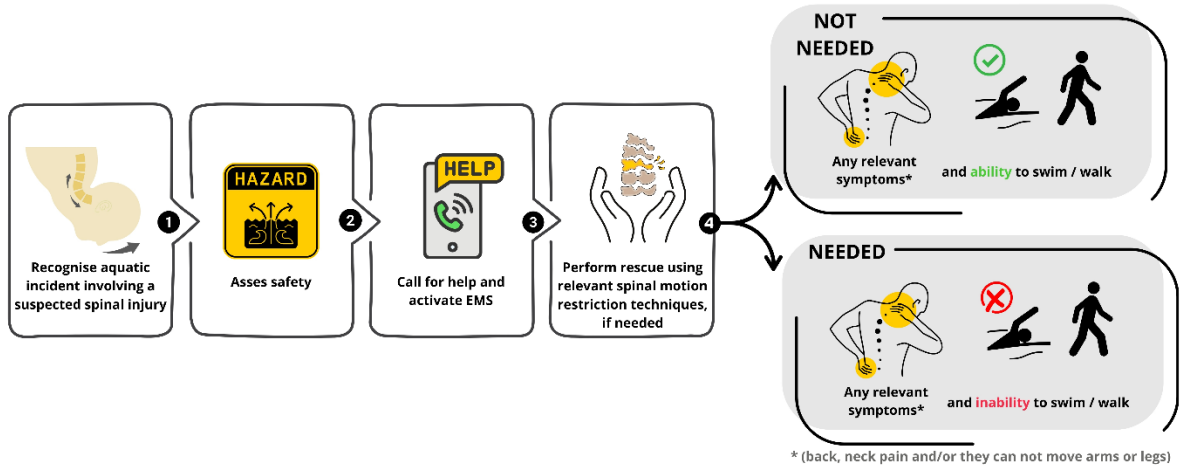

Figure 1: The overall management principles of the person with a suspected traumatic spinal cord injury.

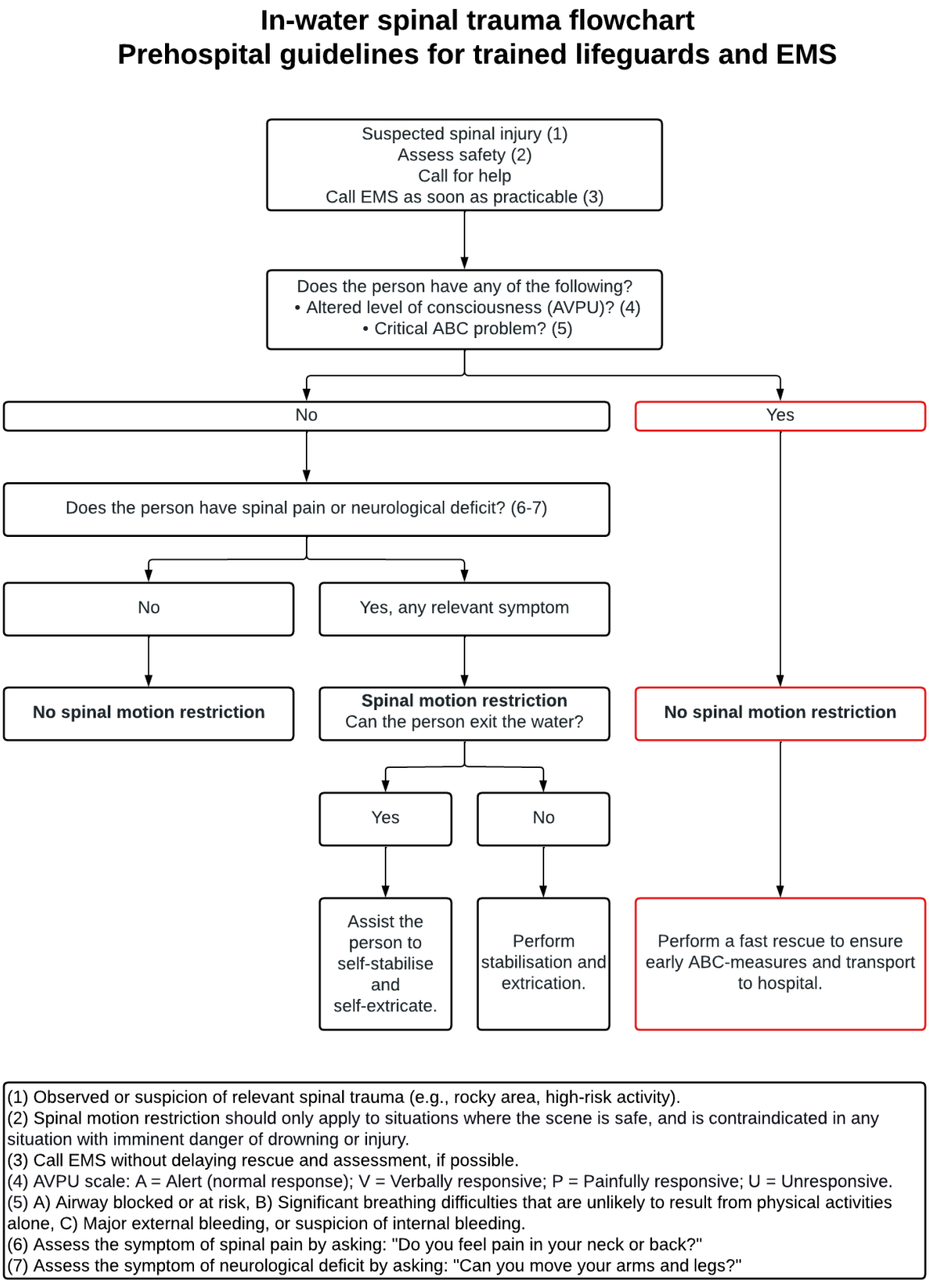

Figure 2: Prehospital guidelines on in-water traumatic spinal cord injuries for trained lifeguards and EMS.

Recognise aquatic incident involving a suspected spinal injury

Lifeguards and prehospital EMS should suspect a TSCI if a relevant trauma is observed or suspected. This includes activities with a high risk of spinal injury, such as diving into shallow water, and injuries related to water sports wipeouts like surfing, wing foiling, and kitesurfing in rough conditions, especially in rocky areas. It is important to stress that routine spinal motion restriction should not be used solely based on a history of submersion without a prior traumatic history, as this is time-consuming and likely may have a negative impact on the outcome in a drowned person.[19]

Assess the safety and ask to call for help

If there is an imminent danger of drowning or injury (e.g., rocky areas, high surf, or fast-moving water), rapid rescue and towing to safety should be prioritised instead of extrication and spinal motion restriction, as attempting SMR could introduce additional risks to both the person and rescuers. Ask someone to call for help early and activate the EMS.[20]

Perform rescue based on any relevant symptoms

Sometimes, the person's condition demands rapid rescue and towing to safety instead of extrication and spinal motion restriction. These situations include:

1. The person has an altered level of consciousness (including respiratory or cardiorespiratory arrest)
2. The person has a critical Airway, Breathing, or Circulation (ABC) problem, including a blocked airway, significant breathing difficulties unlikely to result from physical activities alone, major external bleeding, or suspicion of internal bleeding.

If the person is alert with no critical ABC problem, the lifeguard should assess the need for spinal motion restriction in suspected traumatic spinal cord injuries. Comprehensive clinical assessments in the aquatic environment are challenging even for medical experts. Therefore, it is recommended that the lifeguard asks two questions to assess the need for spinal motion restriction[21]:

1. "Do you feel pain in your neck or back?" and
2. "Can you move your arms and legs?"

Language barriers will challenge history taking, but persons with language barriers should be treated in the same way as all other alert persons.[22] The lifeguard may assess spinal pain by interpreting the person's facial expressions and neurological deficits by observing the person's spontaneous movements in arms and legs. If the person has no relevant symptoms (no spinal pain and normal movement in arms and legs), spinal cord injury should not be suspected, and spinal motion restriction should not be performed.[21,23–27]

1. *Any relevant symptoms but able to swim and/or walk*

If the person answers yes to either or both of the above questions, but is still able to walk, they will preferentially stabilise their injured body parts in the most comfortable position, preventing further injury.[21,28,29] This is also the case for suspected spinal injuries. The lifeguard and EMS should allow self-extrication and avoid spinal motion restriction.[30] Lifeguards should constantly support the person to reduce the risk of falling, protect from waves, remove submerged objects, etc.

2. *Any relevant symptoms and inability to swim and/or walk*

If the person answers yes to either or both of the above questions, but cannot walk, lifeguards should perform spinal motion restriction while extricating the person from the water. Avoid the use of cervical collars, as there are no proven benefits on neurological outcomes or mortality, and they are known to cause numerous harmful effects.[26–28,31–38] Instead, the person's head should be stabilised in relation to the upper body with a two-hand technique suitable for the situation during the extrication (Figure 3).

Figure 3: Lifeguards practising transferring a person with suspected in-water traumatic spinal cord injury from the water to an EMS meeting point on the beach using a spinal board without straps. In this figure, the person has experienced a relevant traumatic mechanism, has relevant symptoms and cannot perform self-extrication. A neutral head position is maintained with a two-hand technique.

No single spinal motion restriction and extrication method is ideal for all situations. They should be applied based on factors such as the person's body, physical position, and location. However, a face-down person with a suspected in-water traumatic spinal cord injury should immediately be turned face-up while securing a stable position of the head in relation to the upper body during the turn to allow clinical assessments. Various techniques can be used, but no evidence exists to favour one method. Some techniques mentioned in the existing teaching material include the "extended arms grip" (Figure 4) and "vise grip" (Figure 5), which are suitable for deep and shallow water. The “body hug” (Figure 6) can be used in beach settings for fast extrication. These techniques allow to role the person into a face-up position.

To achieve effective SMR, the ideal number of trained lifeguards in these techniques should be no fewer than two in swimming pools and three in natural aquatic environments.

In calm water, a lightweight device like a spinal board, surfboard, or similar that floats and drains water is appropriate for extrication. Using straps may be time-consuming

and may increase the risk of aspiration. Hence, straps should not be used unless required for safe extrication to prevent the person from sliding off the board (e.g., due to pool design or boat).

In the surf, using a board is highly inappropriate and increases the risk to the person and the lifeguard.

If the person cannot walk, a lightweight device can also facilitate transfer from the beach to a meeting point with the EMS for further evaluation and subsequent ambulance transport.

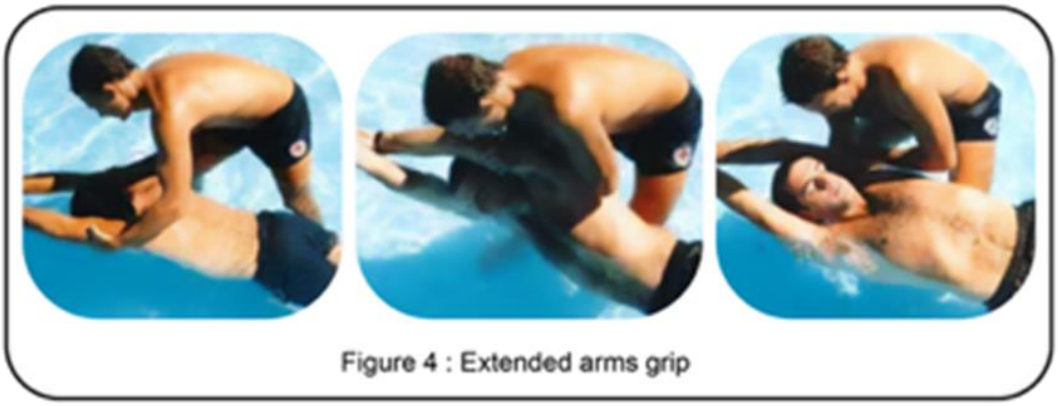

Figure 4 : Extended arms grip

Figure 5 : Vice grip

Figure 6 : Body hug

Management on land

The lifeguard should provide standard care according to their training (e.g., using a structured approach like "ABCDE" or similar for the person's assessment and treatment). A person who is conscious and fully alert can stabilise their own head.

In the case of an unresponsive person, the lifeguard should manually stabilise the person's head by holding it while positioned above the head in the supine position, either lying or kneeling. If the person's airway is obstructed, the lifeguard should open the airway by repositioning the person's head into a neutral, in-line position and using the jaw thrust manoeuvre. If an open airway cannot be achieved with the head in a neutral position, the lifeguard should use the head tilt-chin lift manoeuvre. [39] If the person is unconscious and not breathing normally, the lifeguard should start cardiopulmonary resuscitation according to the standard basic life support protocol for a drowned person.[40]

Log Roll

A. Supine position. The log roll is a manoeuvre performed by a trained team to roll a person from a supine position onto their side and then flat again, allowing better airway management, back examination for injuries or bleeding, and facilitating using a spinal backboard.

When performing the log roll, it's crucial to maintain spinal stabilisation, with one team member stabilising the head and neck to prevent unnecessary movements. Coordination and communication within the team are fundamental to successfully handling persons with suspected spinal cord injuries to achieve SMR.

B. Prone position. If the person is in a prone position, a stabilisation method recommended for the supine position can be used but needs a rotation. The person is rolled from the prone position onto their side (lateral position) to allow for placing a spinal board or airway management if needed. The movements should be smooth and synchronised to avoid any twisting or bending of the spine. The main point is to ensure that the person's head, neck, and spine are kept in a neutral position throughout the procedure.

SUMMARY

Recently, expert consensus regarding prehospital guidelines on in-water traumatic spinal cord injury was published.[1] This Medical Position Statement aims to standardise training and improve the quality of care lifeguards and prehospital EMS provide. It offers a practical framework, including a flow chart aligned with the latest evidence-based international recommendations. This framework ensures lifeguards can effectively implement spinal motion restriction in aquatic settings.

LEVEL OF EVIDENCE

This document is based on the International Consensus on Science Treatment Recommendations and expert consensus.

POTENTIAL CONFLICT OF INTEREST STATEMENT

None of the participants in the consensus process leading to this position statement has a conflict of interest with the stakeholder industry, technology, persons, or organisations that are identified and/or impacted by the position statement.

AUTHORS

On behalf of the International Life Saving Medical Committee:
Breindahl, Niklas
Manino, Leonardo
Sempsrott, Justin
Bierens, Joost
Barcala-Furelos, Roberto
Sanz Arribas, Ismael

REFERENCES

1. Breindahl N, Bierens JLM, Wiberg S, Barcala-Furelos R, Maschmann C. Prehospital guidelines on in-water traumatic spinal injuries for lifeguards and prehospital emergency medical services: an international Delphi consensus study. *Scand J Trauma Resusc Emerg Med*. 2024;32(1):76. doi:10.1186/s13049-024-01249-3

2. Ahuja CS, Wilson JR, Nori S, et al. Traumatic spinal cord injury. *Nat Rev Dis*

Primers. 2017;3(1):17018. doi:10.1038/nrdp.2017.18

3. Chang SKY, Tominaga GT, Wong JH, Weldon EJ, Kaan KT. Risk Factors for Water Sports-Related Cervical Spine Injuries. *The Journal of Trauma: Injury, Infection, and Critical Care*. 2006;60(5):1041-1046. doi:10.1097/01.ta.0000218256.39295.8f

4. Torg JS. Epidemiology, pathomechanics, and prevention of athletic injuries to the cervical spine. *Med Sci Sports Exerc*. 1985;17(3):295-303.

5. Tator CH, Fehlings MG. Review of the secondary injury theory of acute spinal cord trauma with emphasis on vascular mechanisms. *Journal of Neurosurgery*. 1991;75(1):15-26. doi:10.3171/jns.1991.75.1.0015

6. Choo AM, Liu J, Lam CK, Dvorak M, Tetzlaff W, Oxland TR. Contusion, dislocation, and distraction: primary hemorrhage and membrane permeability in distinct mechanisms of spinal cord injury. *SPI*. 2007;6(3):255-266. doi:10.3171/spi.2007.6.3.255

7. Oyinbo CA. Secondary injury mechanisms in traumatic spinal cord injury: a nugget of this multiply cascade. *Acta Neurobiol Exp (Wars)*. 2011;71(2):281-299.

8. Ray SK, Dixon CE, Banik NL. Molecular mechanisms in the pathogenesis of traumatic brain injury. *Histol Histopathol*. 2002;17(4):1137-1152. doi:10.14670/HH-17.1137

9. Rossignol S, Schwab M, Schwartz M, Fehlings MG. Spinal Cord Injury: Time to Move? *Journal of Neuroscience*. 2007;27(44):11782-11792. doi:10.1523/JNEUROSCI.3444-07.2007

10. Amorim EC, Vetter H, Mascarenhas LB, Gomes EG, Carvalho JBF, Gomes JF. Spine trauma due to diving: main features and short-term neurological outcome. *Spinal Cord*. 2011;49(2):206-210. doi:10.1038/sc.2010.79

11. Bailes JE, Herman JM, Quigley MR, Cerullo LJ, Meyer PR. Diving injuries of the cervical spine. *Surgical Neurology*. 1990;34(3):155-158. doi:10.1016/0090-3019(90)90064-V

12. Bárbara-Bataller E, Méndez-Suárez JL, Alemán-Sánchez C, Sánchez-Enríquez J, Sosa-Henríquez M. Lesión medular secundaria a zambullida en Canarias. *Neurocirugía*. 2017;28(4):183-189. doi:10.1016/j.neucir.2017.01.005

13. Chan-Seng E, Perrin FE, Segnarbieux F, Lonjon N. Cervical spine injuries

from diving accident: A 10-year retrospective descriptive study on 64 patients. *Orthopaedics & Traumatology: Surgery & Research*. 2013;99(5):607-613. doi:10.1016/j.otsr.2013.04.003

14. Frankel HL, Montero FA, Penny PT. Spinal cord injuries due to diving. *Spinal Cord*. 1980;18(2):118-122. doi:10.1038/sc.1980.19

15. Griffiths ER. Spinal injuries from swimming and diving treated in the spinal department of Royal Perth Rehabilitation Hospital: 1956-1978. *Spinal Cord*. 1980;18(2):109-117. doi:10.1038/sc.1980.18

16. Kiwerski J. Cervical spine injuries caused by diving into water. *Spinal Cord*. 1980;18(2):101-105. doi:10.1038/sc.1980.16

17. DeVivo MJ, Sekar P. Prevention of spinal cord injuries that occur in swimming pools. *Spinal Cord*. 1997;35(8):509-515. doi:10.1038/sj.sc.3100430

18. Korres DS, Benetos IS, Themistocleous GS, Mavrogenis AF, Nikolakakos L, Liantis PT. Diving injuries of the cervical spine in amateur divers. *The Spine Journal*. 2006;6(1):44-49. doi:10.1016/j.spinee.2005.06.013

19. Watson RS CP. Cervical spine injuries among submersion victims. *J Trauma*. 2001;51(658–62).

20. Australian Resuscitation Council, New Zealand Resuscitation Council. ANZCOR Guideline 9.1.6: Management of Suspected Spinal Injury. Published online January 2016. Accessed January 2, 2023. https://www.resus.org.nz/assets/Uploads/ANZCOR-Guideline-9-1-6-Spinal-Jan16.pdf

21. Maschmann C, Jeppesen E, Rubin MA, Barfod C. New clinical guidelines on the spinal stabilisation of adult trauma patients - consensus and evidence based. *Scand J Trauma Resusc Emerg Med*. 2019;27(1):77. doi:10.1186/s13049-019-0655-x

22. National Association of Emergency Medical Technicians (U.S.), Pre-Hospital Trauma Life Support Committee, American College of Surgeons, Committee on Trauma. Spinal Trauma. In: *Emerton C, Editor. PHTLS® Prehospital Trauma Life Support.* 8th ed. Burlington, MA: Jones & Bartlett Learning; 2016:289-314.

23. Freauf M, Puckeridge N. TO BOARD OR NOT TO BOARD: AN EVIDENCE REVIEW OF PREHOSPITAL SPINAL IMMOBILIZATION. *JEMS*. 2015;40(11):43-45.

24. Lerner EB, Billittier AJ, Moscati RM. The effects of neutral positioning with and

without padding on spinal immobilization of healthy subjects. *Prehospital Emergency Care*. 1998;2(2):112-116. doi:10.1080/10903129808958853

25. Ham WHW, Schoonhoven L, Schuurmans MJ, Leenen LPH. Pressure ulcers, indentation marks and pain from cervical spine immobilization with extrication collars and headblocks: An observational study. *Injury*. 2016;47(9):1924-1931. doi:10.1016/j.injury.2016.03.032

26. Purvis TA, Carlin B, Driscoll P. The definite risks and questionable benefits of liberal pre-hospital spinal immobilisation. *The American Journal of Emergency Medicine*. 2017;35(6):860-866. doi:10.1016/j.ajem.2017.01.045

27. Connor D, Greaves I, Porter K, Bloch M, On behalf of the consensus group, Faculty of Pre-Hospital Care. Pre-hospital spinal immobilisation: an initial consensus statement. *Emerg Med J*. 2013;30(12):1067-1069. doi:10.1136/emermed-2013-203207

28. Benger J, Blackham J. Why Do We Put Cervical Collars On Conscious Trauma Patients? *Scand J Trauma Resusc Emerg Med*. 2009;17(1):44. doi:10.1186/1757-7241-17-44

29. Rogers L. No place for the rigid cervical collar in pre-hospital care. *International Paramedic Practice*. 2017;7(1):12-15. doi:10.12968/ippr.2017.7.1.12

30. Zideman DA, Singletary EM, Borra V, et al. European Resuscitation Council Guidelines 2021: First aid. *Resuscitation*. 2021;161:270-290. doi:10.1016/j.resuscitation.2021.02.013

31. Patel MB, Humble SS, Cullinane DC, et al. Cervical spine collar clearance in the obtunded adult blunt trauma patient: A systematic review and practice management guideline from the Eastern Association for the Surgery of Trauma. *Journal of Trauma and Acute Care Surgery*. 2015;78(2):430-441. doi:10.1097/TA.0000000000000503

32. Hood N, Considine J. Spinal immobilisaton in pre-hospital and emergency care: A systematic review of the literature. *Australasian Emergency Nursing Journal*. 2015;18(3):118-137. doi:10.1016/j.aenj.2015.03.003

33. Kornhall DK JJ. The Norwegian guidelines for the prehospital management of adult trauma patients with potential spinal injury [internet]. *Scand J Trauma Resusc Emerg Med*. Published online 2017.

34. Barati K AM. The effect of soft and rigid cervical collars on head and neck immobilization in healthy subjects. *Asian Spine J*. 2017;11(390–5).

35. Ivancic PC. Do Cervical Collars and Cervicothoracic Orthoses Effectively Stabilize the Injured Cervical Spine? A Biomechanical Investigation: *Spine*. 2013;38(13):E767-E774. doi:10.1097/BRS.0b013e318290fb0f

36. Horodyski M, DiPaola CP, Conrad BP, Rechtine GR. Cervical Collars are Insufficient for Immobilizing an Unstable Cervical Spine Injury. *The Journal of Emergency Medicine*. 2011;41(5):513-519. doi:10.1016/j.jemermed.2011.02.001

37. Davies G DC. The effect of a rigid collar on intracranial pressure. *Injury*. 1996;27(647–9).

38. Maissan IM, Ketelaars R, Vlottes B, Hoeks SE, den Hartog D, Stolker RJ. Increase in intracranial pressure by application of a rigid cervical collar: a pilot study in healthy volunteers. *European Journal of Emergency Medicine*. 2018;25(6):e24-e28. doi:10.1097/MEJ.0000000000000490

39. International Life Saving Federation Medical Committee. Medical Position Statement 21: Spinal Injury Management. Published online 2016.

40. Berg KM, Bray JE, Ng KC, et al. 2023 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations: Summary From the Basic Life Support; Advanced Life Support; Pediatric Life Support; Neonatal Life Support; Education, Implementation, and Teams; and First Aid Task Forces. *Resuscitation*. 2024;195:109992. doi:10.1016/j.resuscitation.2023.109992

APPROVAL

Developed by the ILS Medical Committee in June 2016

Endorsed by the Rescue Commission in June 2016

Adopted by the ILS Board in September 2016

Revised by the ILS Medical Committee in September 2025