Cervical Spinal Splinting; Where’s the Evidence?

By:

Martin Rizo Patron
Inventor-Developer, Firefighter-EMT-D,
U.S. ARMY “Deep Sea Diver”
(Underwater Construction Technician)

Thank you for the opportunity!
Analysis of the Management for Potential Spinal Injuries in EMS

- Epidemiology.
- Clinical and empirical evidence:
  - Shortfalls of commonly used tools and techniques.
  - Commonly used protocols and practices.
  - Procedures from a field prospective.
- Cervical Splinting technology basics.
- C-Splinting practical demonstration.
- A New Paradigm publications and evidence.
Epidemiology

- Yearly in the US., EMS providers treat over 5 million patients for potential CSIs. (19, 20).
- Approximately 14,000 CSIs are reported and between 4,000 to 5,000 trauma patients die as a result of these injuries. (1)
- Up to 25% of all CSIs occur after initial trauma; during early stages of patient management or transport, and 40% of these result in neurological deficit. (2, 3, 4, 5, 6, 7)
- Survivors of CSIs with neurological disability and their families must endure substantial physical, psychological and emotional stress.
- Financial burden can rise above $100,000 during the first year of treatment alone. Estimated cost related to U.S. society is approx. 5 billion dollars per year. (30)
Authors' conclusions
We did not find the evidence to support the routine use of spinal immobilisation on mortality, neurological injury, spinal stability and adverse effects in trauma patients. Spinal immobilisation is a major cause of preventable death in trauma patients, and spinal immobilisation, particularly of the cervical spine, can contribute to airway compromise, the possibility that immobilisation may increase mortality and morbidity cannot be excluded. Large prospective studies
Shortfalls Found with the Use of Conventional Tools and Procedures

- Rigid C-Collars (adjustable or multi-size).
- Long spinal boards/straps.
- Head immobilization devices.
- A view as how these relate to the procedures and operations in the field
1) **Shortfalls with C-Collars:**
- Conventional c-collars have the tendency to distract (stretch) the cervical spine. (15, 29)
  - This effect occurs due to their wedge like design.
- Creation of a pivot point which makes it more difficult to move patients safely. (36)
- Increased ICP due to venous return blockage.
- Designed to keep the head In-Line ONLY.
Conventional C-Collars Can Do More Harm Than Good!

Collar Me Bad

There’s little in EMS more automatic than applying cervical collars to patients with possible neck injuries. That doing this might in some cases harm them is a horrifying prospect. But that’s an implication raised by research published earlier this year by the Journal of Trauma.

A team led by Baylor University orthopedist Peleg Ben-Galim, MD, found that using extrication collars in the presence of severe dissociative neck injuries can result in abnormal separation within the upper cervical spine. On cadaver models with recreated c-spine injuries, collars produced a separation of 7.3 +/- 4.0 mm between C1 and C2.

“The cervical collar, in the case of a really bad injury, not only doesn’t protect the spine, but can actually make things a lot worse.”

The cadaver recreations were based on real cases. Researchers cut the bodies’ neck ligaments and membranes but left supporting musculature, then captured images by x-ray, fluoroscopy and/or CT scan before and after application of a rigid collar and some typical patient maneuvers. Distraction was clearly visible—the collar consistently pushed the head up and away from the shoulders. In a living patient with unstable cervical anatomy, this could contribute to secondary injury—or worse.

What this means for EMS, though, probably isn’t all that much yet. It’s certainly not enough to send systems out changing standards of care. C-collars remain appropriate and safe for most of the patients on whom they’re used. But there are definitely
Distraction Upon C-Collar Application
Another Drawback Against the Use of Conventional C-Collars

Head Hinges Upon Collar's Edge
Conclusions: Early assessment of the cervical spine in head-injured patients is recommended to minimize the risk of intracranial hypertension related to prolonged cervical spine immobilization with a hard collar.
C-Collar Application Techniques

Gross Approximation
2) **Long Spinal Boards:**

- Due to the rigidity of the surface at the contact points and the time spent laying on these devices, skin ulcers and sores start to develop. (32, 35)

- Tightness of the straps over the thoracic region has been found to limit respiratory function by 15 to 20 %. (11, 18, 33)

- Due to the pain experienced patients tend to move in an attempt to alleviate the pressure points potentially aggravating existing injuries.
3) **Head Immobilizers:**

- Improper Spine Alignment.

- Occipital support is needed for spine alignment. (12, 13)

- Over 80% of adults require 1.3 to 5.1 cm. of padding for proper spine alignment. (14)

- Unwanted Manipulation of the Cervical Spine occurs due to dynamic forces during transport. (19)
EMS Spinal Precautions and the Use of the Long Backboard Position Statement of the National Association of EMS Physicians and the American College of Surgeons Committee on Trauma Mach, 2013
Faculty of Pre-Hospital Care an Initial Consensus Statement. December 2013

- Consensus Statement Outcomes:

1. The long spinal board is an extrication device solely. Manual in-line stabilisation is a suitable alternative to a cervical collar.

5. ‘Standing take down’ practice should be avoided.
Encourages local EMS Authorities to develop updated Spinal Management Protocols.

Stresses the need for discontinuing the use of Long Rigid Spinal Boards for patient transport.
ACEP Statement Extracts

Backboards, cervical collars, straps, tape, and similar devices (e.g., sand bags, head wedges). Evolving scientific evidence demonstrates that some of these current out-of-hospital care practices cause harm including airway compromise, respiratory impairment, aspiration, tissue ischemia, increased intracranial pressure, and pain, and can result in increased use of diagnostic imaging and mortality.

EMS medical directors should provide evidence-based spinal motion restriction protocols and procedures that describe specific indications and contraindications for application of spinal motion restriction. The role of adjuncts (e.g., cervical collars) should be specifically addressed. The use of spinal motion restriction procedures and adjuncts should not interfere with critical airway management.

Backboards should not be used as a therapeutic intervention or as a precautionary measure either inside or outside the hospital or for inter-facility transfers. Spinal immobilization should not be used for patients with penetrating trauma without evidence of spinal injury.
A New Paradigm in Cervical Spinal Management

Cervical Spinal Splinting
The “XCollar” is NOT a C-Collar, It's a Cervical Spinal Splinting Technology

- It is a complete C-Spine Splinting System.
- Designed by looking back at the basics.
- Most effective, least intrusive treatment. available to protect the Cervical Spine.
The ONLY ONE that splints the cervical spine

ABOVE

&

BELOW
Cervical Splinting System

Position Found

Pictures: www.xcollar.com
C-Splinting Demonstration

- Timed evolution
- Technique
- Results
A COMPARISON OF THREE CERVICAL IMMOBILIZATION DEVICES

David Hsust, PhD, Deanna Colburn, MPT, S. Robert Setz, MED

ABSTRACT

Objective. Prehospital cervical spinal cord injuries (SCI) are rare but potentially catastrophic. Although spinal immobilization is resource-intensive, emergency medical services (EMS) personnel commonly immobilize trauma patients to prevent exacerbation of unrecognized SCI during transport. We compared the stabilization properties of a novel rigid, cervical immobilization collar (XCollar) with those of one-piece and two-piece rigid collars commonly used in the prehospital setting.

Methods. This was a prospective laboratory study of healthy adult volunteers to determine total cervical motion in the horizontal, coronal, and sagittal planes in both seated and supine positions. Geometric techniques were used to measure head and neck movement after marking anatomic landmarks. Ranges of motion were compared with a one-way analysis of variance (ANOVA). A Bonferroni correction was applied for multiple comparisons, setting significance at \( p \leq 0.004 \). Results. Twenty-five subjects (11 men, 14 women) completed the study. The study pool represented a wide range of morphometrics. For most measurements, the XCollar permitted 10-15 millimeters of movement when applied without manual cervical stabilization. This was less than the movement permitted by both comparison collars. On average, the XCollar permitted less than 50 millimeters of movement in the sagittal and horizontal planes when the subject was in the seated position. Conclusions. The XCollar provided superior cervical stabilization without augmentation by manual stabilization in healthy adult volunteers in both the seated and supine positions when compared with other piece and two-piece rigid cervical collars. Although maximal stabilization was achieved only after the subjects were secured to a long spine board with a cervical immobilization device, the XCollar can provide an acceptable alternative to manual cervical stabilization in situations where the number of patients exceeds the number of EMS providers available to provide care. Key words: prehospital; immobilization; cervical; range of motion

PREHOSPITAL EMERGENCY CARE 2009;13:2356-2360

INTRODUCTION

Cervical spine immobilization is commonly performed in the prehospital setting when treating patients suffering from a traumatic injury. Although spinal cord injury (SCI) is uncommon in the context of total prehospital patient encounters, up to 20,000 cases may occur annually in the United States and Northern Europe. Exacerbation of SCI during extrication or transport can be catastrophic, typically resulting in overtriage by emergency medical services (EMS) providers and prophylactic immobilization with a cervical collar and long spine board.

Multiple studies have examined prehospital cervical immobilization collars. Although differences in collar effectiveness have been identified, many studies indicate that immobilization with a cervical collar alone is not sufficient and that manual stabilization should be applied until the patient is secured to a long spine board and cervical blocks are applied.1-5 However, this recommendation requires two rescuers to attend to each patient, one to maintain manual cervical stabilization and one to assess and prepare the patient for extrication. This may not be practical in a mass casualty incident where even a small number of patients can overwhelm the initial responder’s resources. This study compared a novel cervical immobilization collar with two commonly used prehospital cervical collars to determine the extent to which the head can be immobilized without manual cervical stabilization in both the supine and seated positions.

METHODS

The University of Pittsburgh Institutional Review Board approved this study. All subjects provided informed consent prior to any procedures being performed.

Subject Population

Subjects were recruited from the local university and medical center community. Eligible subjects were 18 years or older of either gender. Subjects were excluded if they self-reported claustrophobia or a medical
### Performance Comparison: XCollar alone vs. others in full “c-spine”

<table>
<thead>
<tr>
<th>Flex-Extension</th>
<th>L-R Flexion</th>
<th>L-R Rotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

*all measurements represent total range of movement in cm*

Graph 3: Notice that in the Left-Right Rotation and Flexion planes the average range of motion measured for patients in the XCollar alone was less than and approximately equal to (within 0.10cm) the average range of motion measured for patients in the other collars with backboards and head restraints. (Measurements for the Flexion/Extension plane of Motion were not collected when head restraints were utilized.)

The XCollar, when used alone, offers better immobilization when treating a single patient. The benefits of this technology therefore increase exponentially during multiple casualty incidents. In these cases, the XCollar/Nexspint cervical immobilization system can effectively liberate a first responder from the obligation of holding manual cervical immobilization. This allows a single rescuer to initiate cervical immobilization to multiple patients in a much shorter time and without compromising patient safety.
Field Trial Dallas Fire-Rescue Dept.

DALLAS FIRE RESCUE DEPARTMENT
FIELD TRIAL RESULTS OCTOBER 2010

The XCollar Provides Improved Immobilization Capabilities

- 98% Agree
- 0% Neutral
- 2% Disagree

The XCollar Provides Better Stabilization & Safety

- 86% Agree
- 12% Neutral
- 2% Disagree

The XCollar Allows for C-Spine in Position of Comfort

- 75% Agree
- 23% Neutral
- 2% Disagree

The XCollar Provides New & Improved C-Spine Capabilities
Greater patient safety • Fits a greater range of patient sizes (from approx. 22 to over 360 lbs)
Allows application in "Position Found" • Expedites treatment and acts as a force multiplier curing MCI
Lee County EMS analysis of the XCollar

26 January 2013
Better Patient Stabilization

Proper fit for pediatric and adult patients?

Immobilization in Position of Comfort or Position Found? (if applicable)

Better inline patient stabilization using the adjustable Head Restraint System (HRS)?
From a clinical standpoint, 2015 was another exciting, productive year! Some of the most notable highlights include:

**The Cervical Spine XCollar**

Conventional cervical collars that are commonly placed on patients in motor vehicle crashes or following falls to protect the neck from further injury have significant limitations. They are relatively uncomfortable and, more importantly, they often allow significant movement of the neck which negates their value as a protective device. In the last year, Richmond Ambulance Authority successfully implemented a program deploying a newly designed, highly effective device called the XCollar. This clever device splints the neck in the "position of comfort" and is capable of customizing to fit varying patient body types. It provides unprecedented protection of the spine that is superior to any other device on the market. The XCollar has an oversized opening in the front to allow paramedics to check the patient’s pulse. It is made of latex-free materials and allows excellent quality x-rays to be taken with it in place after the patient arrives at the hospital. The device is now used in over 36 countries worldwide. Richmond Ambulance Authority is one of the first agencies in the United States to deploy the device.
Attelle cervico-thoracique X Collar

Une révolution dans l’immobilisation du rachis cervical


Attelle cervicale

Au total, les colliers cervicaux actuellement utilisés n’offrent une immobilisation efficace que de la partie médiane du rachis cervical dans l’axe antéro-postérieur.

Le système X Collar est une véritable attelle cervicale. Il dispose d’une structure arrière en triangle, pointue vers le bas, qui se positionne entre les omoplates et d’un dispositif réglable à l’avant qui s’adapte aux contours de l’axe cervical d’une attache clip puis ajustée à la taille de la victime. Un dispositif de réglage de la circonférence permet une adaptation aisée à un enfant comme à un adulte. Il faut ensuite régler le dispositif d’appui sternal et finir en fixant les sangles de maintien latéral.

Un système de fixation de l’attelle cervicale sur un plan dur est à l’étude.

Formation préalable

La mise en œuvre de ce nouveau matériel nécessite une formation préalable. La procédure à suivre reste globalement conforme aux prescriptions du référentiel national de secourisme, ce qui ne devrait pas bouleverser les process actuels.

Ce nouveau dispositif d’immobilisation apporte une plus-value indéniable à la qualité de la prise en charge de la victime traumatisée. Seul bé-mol : la mise en place du triangle dans le dos...
Even before Emergency Medical Services were established, rescue personnel have been using their best efforts to save patients by means of current techniques and equipment available. This medical sub-specialty has been evolving thanks to the continued improvement of its methods and tools necessary to meet the needs of critical patients in the hardest conditions.

The need to improve the way C-Spine management has been performed for decades became evident to me after applying hundreds if not thousands of conventional C-collars on patients. As an EMS provider, I always reassured and told our patients “please do not move” and “this
Cervical Splinting Offers a New Paradigm in EMS

X Collar encourages a new method for practicing c-spine management

Posted: May 24th, 2011 11:53 AM CDT

By Martin Rizo Patron

Even before EMS was established, rescue personnel have used their best efforts to save patients by means of current techniques and equipment available. Since its infancy, emergency medicine has evolved thanks to continued improvements in the methods and tools necessary to meet the needs of critical patients in challenging conditions.
Cervical Splinting:
A New Paradigm in EMS

First responders are today immobilizing casualties with spinal cord injuries without having to wait for traditional equipment to arrive on scene.

By Martin Rizo-Patron, president-founder, Emegear, LLC
DISCRIMINATE SPINAL IMMobilIZATION

How Lee County (Fla.) EMS implemented a new paradigm of cervical spine management

By Michael G. Hamel, NREMT-P, CCEMT-P, FF-C

A s EMS professionals, we are obliged to adhere to the principle of primum non-nece

met, “First, do no harm.” But as the EMS industry becomes more protocol-driven, the t

endency to think outside the box is often discouraged. Practices that seem like common

sense become less common, and for many providers, the notion of doing no harm can be 

problematic. This notion can be magnified when individuals or departments repeatedly accept a lower 

standard of performance until that lower standard becomes the norm. This behavior is known 

as normalization of deviance. In EMS, normalization of deviance can be defined as performing 

defacto procedures that appear to be absent of harm or deemed safe by tradition, when in fact they 

are not. Providers end up performing “accidental” procedures that may not be beneficial or may 

have undesirable patient outcomes.

This is especially true for spinal immobilization procedures. For example, applying a cervical collar 
(Collar) and appropriating an 85-year-old hypertensive patient with a closed head 

injury, whose only examination finding was a scalp laceration secondary to a general 

level trip-and-fall, may not be the best course of action.

Lakewood, fully immobilizing an admitted mental status patient with a closed head 

injury who has a stomach full of alcohol and substantial artery pressure pulses may 

also be a poor choice treatment modality for more than 30 years. EMS professionals in the 

United States have sought for spinal immobilization techniques that have been opposed by 

many providers, but newer systems are calling the techniques into question.

IMPROVING IMMobilIZATION

In late 2011, Lee County Public Safety/EMS (LCEMS) located in Fort Myers, Fla., set 

out to evaluate innovative immobilization techniques. LCEMS first examined the C-collar used in 

the system to determine if any weaknesses could be identified. The agency found that the 

elbow collar was inadequate in terms of its ability to splint a patient’s cervical spine (C-spine) and 

improve overall head resuscitation.

A team of experienced paramedics further discussed the patient’s lateral head 

movement, although limited, was noted in certain images. This led to the traditional collar 

creating an uncomfortable “snagging” space between the patient’s head and torso in recent 

cases. Although the conclusion of this wedge could not be thoroughly validated in the out-of-

hospital environment, it was decided that the wedge had the potential to create 

C-spine distraction—visibly counterproductive to the patient expected of having a 

widespread spinal cord injury.

The agency then examined other collars on the market to evaluate their ability 

to splint the C-spine. None of these was found to be better than the collar already in use. 

Dissatisfied but not defeated, the team continued to research alternative 

methods and eventually discovered the X-Collar by Engage. The X-Collar, with its unique 

C-spine sphenoid capability, immediately caught the agency’s attention. But for 

various reasons unassociated to the product, the X-Collar was not fully approved, and was 

ultimately placed in a drawer.

NEW DEVICE, NEW GUIDELINE

In mid-2012, a unit encountered a patient from the same hospital system who 

required cervical immobilization, representing from Engage were contacted by Fort Myers to 

present the X-Collar. The presentation was well received. The X-Collar’s ability to splint the 

C-spine became more impressive to our team.
New Protocols/Algorithm Examples

ETMC Spinal Motion Restriction (SMR) U - 05

El Dorado Spine Immobilization 2015 Draft
More Examples of Updated Protocols:

Napa County EMS Spinal Immobilization Protocol

LCEMS Discriminate Spinal Immobilization Algorithm (2)
Conclusions:

Cervical Spinal Splinting Technology Allow Providers to:

- Make Updates on their medical guidelines.
- Provide better quality of patient care and safety.
- Provide for early treatment while avoiding further injury.
- “Force Multiplier” as one rescuer can provide treatment for multiple patients.
- Early transport and reduced times on scene.
- Be ready to respond to other emergencies faster.
- Increase provider’s morale.
Works Cited

Works Cited


11) Totten VY, Sugarman DB: Respiratory effects of spinal immobilization. Pre-Hospital Emerg Care 3:347-352, 1999


16) Irene Kwan, MSc; Frances Bunn MSc Effects of Prehospital Spinal Immobilization: A Systematic Review of Randomized Trials on Healthy Subjects., Pre-Hospital and Disaster Medicine 2005.


19) Neurosurgery, Vol. 50, No. 3, March 2002 Cervical Spine Immobilization Before Admission to the Hospital


21) Spinal Stabilization & Management
   Karim Brohi, trauma.org 7:4, April 2002
   (http://www.trauma.org/archive/spine/cspine-stab.html)
Works Cited


Works Cited

Cervical Spinal Splinting:

Here is the Evidence!

THANK YOU FOR

YOUR ATTENTION!