New Thinking on Spinal Immobilization
Santa Cruz County EMS Subcommittee
Spring 2012

One of the defining statements of pre-hospital care is to do no further harm
to patients. Despite a growing body of evidence that traditional spinal
immobilization techniques often cause more injuries than they prevent, traditional
spinal immobilization strategies using a flat long board, stiff cervical collar, head
immobilizer, straps, and tape persist.

While true spinal cord trauma is a devastating injury its actual incidence is
extremely low. In a study that examined one million trauma victims, only 2% had
true spinal cord damage and of that 2%, only 1% had neurological deficits of any
kind. Moreover, there is little data to suggest that our efforts at spinal
immobilization are even effective.

In 1998, a five year, retrospective prehospital chart review was carried out
at the University of New Mexico Medical Center in Albuquerque, New Mexico, and
the University of Malaya, in Malaysia. The study involved the transport of blunt
traumatic spinal or spinal cord injuries directly from scenes to the hospital. The
two hospitals were comparable in physician training and clinical resources. Of
the 120 patients transported to the University of Malaya none had spinal
immobilization during transport, while all of the 334 patients transported to UNM
were transported with full spinal precautions. The results were surprising. There
was less neurologic disability in the non-immobilized Malaysian patients.
Statistical analysis of the study participants yielded a less than 2% chance that
spinal immobilization had any positive effect. The results were similar when the
analysis was limited to patients with cervical injury. The overall conclusion was
that pre-hospital spinal immobilization has little or no effect on neurologic
outcome in patients with blunt spinal injuries.

There is a growing body of evidence that beyond being ineffective, some of
the techniques employed in pre-hospital immobilization not only increase patient
discomfort but lead to further injury. In a study done at Baylor College of
Medicine, it was found that the application of cervical collars can result in
abnormal separation between vertebrae in the presence of dissociative spinal
injuries, causing unnecessary secondary injury. The Baylor study looked
specifically at injuries to the C1 and C2 vertebrae in cadavers. Cervical images
both before and after collar application were taken. On average a 7.3mm separation was caused by cervical collar application. The cervical collar caused a separation between the head and the shoulders, creating a gap between the two vertebrae.

It is also clear that evidence is lacking to suggest that rigid cervical collars are any more effective than a soft foam collar in preventing further injuries in those patients who actually do present with cervical injuries.

Data surrounding backboard use also suggests that their use, while helpful in certain situations, more often than not causes unnecessary discomfort, and in some cases, secondary injury. A study done at L.A. County/USC Medical Center examined twenty-one healthy volunteers with no history of spine or back disease. Subjects were placed in full spinal immobilization for 30 minutes. One hundred percent of the subjects developed pain within the immediate observation period. Headache, lumbar, sacral, and mandibular pains were the most notable symptoms. In another similar study, 21 subjects without spinal disease or trauma were subjected to standard spinal immobilization for 60 minutes. Within 40 minutes three subjects complained of midline cervical pain. Five subjects complained of vertebral body tenderness at 60 minutes and all of the subjects reported being in more midline discomfort at 60 minutes than when they started.

Spinal immobilization causes pain; it can also cause tissue ischemia. In a study performed at the Emergency Medicine Trauma Center, Methodist Hospital, Indianapolis, twenty subjects, again without spinal trauma or existing spinal disease, were placed in standard spinal immobilization for 80 minutes. Half of the group was immobilized with a commercially available air mattress placed between the subject and the board. Tissue interface pressures were recorded at the participants’ occiput, sacrum, and left heel. At the 60 minute mark both pain levels and skin pressures at the three locations were significantly less in those patients that were immobilized with the air mattress method. Low grade pressure induced ulcers can appear within two hours where constant pressures of 70mm/hg have been maintained, a pressure level consistent with standard immobilization practices. In the United States a staggering $11 billion dollars is spent annually to treat pressure ulcers, 60% of which are developed during acute care admissions.

Patients are also spending inordinate amounts of time on backboards once delivered to emergency departments. In a 10 week, prospective study done at SUNY School of Medicine ED, patient backboard times were measured in 138
patients. Total backboard time was measured from the time the ambulance left the scene to the time the patient was removed from the backboard at the hospital. Those patients that were removed from the backboard prior to radiographs averaged 53.9 minutes. For those who remained on the backboard until after radiographs were obtained, the average backboard time was 181.3 minutes.

The goal of extricating a patient with a suspected spinal injury is to minimize manipulation and movement of the spinal column. But perhaps a better goal is to minimize detrimental and painful movement and manipulation. A study done at the University Of Washington School Of Medicine sought to determine what would be the best method by which to extricate victims involved in motor vehicle accidents. A mockup of a 2001 Toyota Corolla that had been subjected to a high speed impact was constructed to scale. It was outfitted with a six-camera motion-capture system by the Motion Analysis Corporation of Santa Rosa, California. Three paramedics, each with greater than five years of field experience, were recruited for the study. One paramedic acted as the driver while the other two performed extrication by four different techniques. The techniques were as follows:

1. The driver was allowed to exit the vehicle on his own volition and lie on a backboard.
2. The driver, with a cervical collar in place, was allowed to exit the vehicle on his own volition and lie on a backboard.
3. The driver was extricated head first using standard extrication methods, which involved wedging the board under the patient, the patient pivoted, and then slid onto the board.
4. The driver was extricated feet first by the same type of standard extrication methods.

The least cervical spinal movement was achieved by having a collared patient self-extricate himself onto a backboard which had been placed on a gurney.

The American Association of Neurological Surgeons and the Congress of Neurological Surgeons acknowledge that it is unlikely that all trauma patients require full spinal immobilization. Moreover, the National Association of EMS Physicians Standards and Clinical Practice Committee came up with a more concrete statement. In patients without ALOC, intoxication, neck or back pain, or distracting injuries, spinal immobilization may be withheld.
In one retrospective study, only 48 out of 13,652 patients with spinal injuries were missed by application of the above mentioned pre-hospital criteria. No patient suffered any adverse outcome. There is also one retrospective study that suggests there is almost no risk of thoracolumbar fractures in ambulatory patients. Another study has shown that routine spinal immobilization of patients who have suffered penetrating trauma to the chest or abdomen actually increases mortality.

True spinal injuries with neurologic involvement are normally pronounced and easily discovered with a diligent physical exam. Moreover, they are very rarely aggravated by not observing complete spinal immobilization procedures, at least in part due to local muscle spasm.

Studies indicate that most patients with possible spinal injuries can be safely transported in a position of comfort and achieve the same spinal protection afforded by traditional immobilization techniques. When cervical trauma is suspected, the patient should be immobilized in an inline position using the most appropriate adjuncts and means to ensure airway patency, and comfort.

EMS crews must have their immobilization equipment cache expanded to go beyond the traditional backboard, collar, head immobilizer, and straps. In fact, backboards are perhaps best viewed as extrication boards and their exclusive use reserved for the multi-systems trauma patient, and even then only judiciously.

The EMS immobilization tool box should include vacuum splints, pneumatic splints, at least some cervical collars that move in more than one plane of motion, and possibly soft collars, in addition to standard spinal immobilization equipment. The choice of immobilization adjuncts should be predicated on the specific requirements of any particular patient. In any case, the choice of immobilization adjuncts should do no harm.

References


