Management of Cervical–Spine Injuries

GIANLUCA DEL ROSSI, MS, ATC/L; MARYBETH HORODYSKI, EdD, ATC/L; and THOMAS W. KAMINSKI, PhD, ATC/L • University of Florida

In order to prevent neurological injuries secondary to those produced by an initial trauma, spinal-column movements of the cervical-spine-injured victim must be restricted as much as possible. Thus, manual in-line stabilization of the head and neck must begin immediately after the injury (American Academy of Orthopaedic Surgeons [AAOS], 1999; American College of Emergency Physicians [ACEP], 1999; Copass, Gonzales, Eisenberg, & Soper, 1998; Jones, Weigel, White, McSwain, & Breiter, 1992; Kleiner et al., 2001; Sanders, 2000). This entails holding the head and neck in alignment with the spine to prevent structural deviations from occurring (AAOS, 1999; ACEP). Then, before the victim can be transported to the hospital, manual stabilization must be replaced with mechanical stabilization or full immobilization to ensure that unwanted movements are not generated during transit. In the case of a cervical-spine injury, full immobilization is accomplished by securing the head, neck, chest, and pelvis of the victim to a long spine board (Jones et al.). Only when the victim has been properly secured to the board is the entire spine supported and the immobilization process complete (Campbell, 2000; Jones et al.).

The task of transferring a victim from the ground to a rigid spine board is accomplished using techniques that are designed to facilitate movement of the victim while still offering protection to his or her spine. Transfer techniques include the log-roll maneuver and the lift-and-slide technique.

The log-roll maneuver has traditionally been the more commonly used method of transferring spine-injured victims (ACEP, 1999; De Lorenzo, 1996; Suter, Tighe, Sartori, & Reed, 1992). This tendency might have developed because of the obscurity of alternative methods (i.e., the lift-and-slide technique). A review of textbooks, handbooks, and scientific-journal articles seems to confirm this suspicion, because most written accounts have focused on the log-roll maneuver, providing only trivial descriptions, if any, of the lift-and-slide technique (AAOS, 1999; ACEP; Arnheim & Prentice, 2000; Campbell, 2000; De Lorenzo; Magee, 1997; Sanders, 2000; Starkey & Ryan, 1996).

Although preferential use of the log-roll maneuver continues to this day, new published guidelines and recommendations (Kleiner et al., 2001) might change the way rescuers care for spine-injured victims. In addition to summarizing the numerous variations of the log-roll maneuver, this article will serve as an instructional aid on the execution of various forms of the lift-and-slide technique, to reinforce the notion that an alternative to the log-roll maneuver is indeed available for use by primary responders.
Overview

A review of written literature and pictorial demonstrations reveals variations of both the log-roll maneuver and the lift-and-slide technique, including personnel requirements, rescuer responsibilities, and spine-board positioning.

The following sections illustrate how these inconsistencies have given rise to the many variations of both types of spine-board transfer techniques.

The Log-Roll Maneuver—Supine Victim

The log-roll maneuver has long been used to transfer injured victims. It is a simple technique with minimal strength requirements. In addition, it can be used regardless of the initial position of the victim (prone or supine). Furthermore, because the victim never fully leaves the ground with this maneuver, the spine remains supported throughout the entire procedure (Cendoma, 2000).

A review of published reports reveals that three to six people might be required to complete one application of the log-roll technique (AAOS, 1999; AAOS & National Safety Council [NSC], 2001; ACEP, 1999; Campbell, 2000; De Lorenzo, 1996; Hafen, Karren, & Mistovich, 1996; Sanders, 2000; Starkey & Ryan, 1996). A three-person log roll requires one rescuer to maintain in-line stabilization and two others to assist in rolling the body (ACEP; Campbell; Hafen; Sanders; Starkey & Ryan). A three-person log roll requires one rescuer to maintain in-line stabilization and two others to assist in rolling the body (ACEP; Campbell; Hafen; Sanders; Starkey & Ryan). It is imperative that the rescuer providing in-line stabilization direct the entire procedure. With a three-person log roll, one rescuer is positioned at the midthorax region—hands located on the victim’s opposite-side shoulder and waist—and another rescuer is positioned near the victim’s knees—hands located at the opposite-side hip and ankle (Figure 1a). When all three rescuers have taken hold of the victim, he or she must be rolled 90° to the side-lying position (ACEP; Campbell; Hafen et al.; Starkey & Ryan). One rescuer is then required to reach over the victim to wedge the spine board beneath him or her at a 45° angle (Figure 1b). If available, a fourth rescuer can also perform this duty (Figure 1c; ACEP; Campbell; Hafen et al.; Sanders; Starkey & Ryan). When the spine board has been properly positioned, the victim can be rolled, carefully, into place on the spine board. If at the completion of this task the victim is not centered on the spine board, longitudinal slides can be used to make the appropriate adjustments (Figures 2a and 2b).

With a four-person log roll, one rescuer maintains in-line stabilization while three rescuers roll the body (AAOS, 1999; AAOS-NSC, 2001; De Lorenzo, 1996; Hafen et al., 1996; Starkey & Ryan, 1996). One rescuer can be located at the level of the shoulders, another at the hip and pelvis region, and still another at the knees (Figure 3). The rescuer at the level of the shoulders can place his or her hands on the victim’s opposite shoulder and over the victim’s opposite arm. The rescuer at the level of the hips can place one hand just above the opposite hip/pelvis and the other at midthigh. The remaining rescuer can place one hand behind the victim’s opposite knee and the other over the opposite lower leg. Together, in a coordinated manner, the rescuers must...
A five-person log roll (typically used on taller or larger individuals; Starkey & Ryan, 1996) requires one rescuer to provide manual in-line stabilization, two rescuers to roll the torso and upper extremities, and two others to assist in rolling the lower extremities (Figure 4). A sixth rescuer, if present, can help with board placement. This procedure is completed in a fashion similar to that of the three- or four-person log roll.

The Log-Roll Maneuver—Prone Victim

As with a supine patient, three to six rescuers can be used to complete the log-roll maneuver on a prone victim. Execution of the log-roll maneuver on a prone victim, however, can take on very different forms. In all cases, a prone-lying victim is rolled opposite the direction in which his or her head is facing.

One method of transferring a prone victim requires that the victim be pulled toward the rescuers (Figure 5a). Before this procedure can be completed, the spine board must be slid into place between the victim and the rescuers by yet another rescuer (Figure 5b). If, however, no additional rescuers are available, the board must be positioned before the procedure begins. This method is eventually completed as the victim is rolled onto the spine board (Sanders, 2000).

A similar approach requires that the spine board be positioned on the ground next to the victim before the procedure begins. To complete this version of the log roll, the rescuers must either start the maneuver by stepping on the board (Figure 6a) or by reaching over the board (Figure 6b; Magee, 1997). If the rescuers choose to start the procedure standing on the board, they must then gradually step off the board as the victim is rolled into place.

An alternative protocol requires that the rescuers gently “push” the victim away from themselves onto a spine board.
that is positioned next to the victim but opposite the rescuers (Figure 7; Arnheim & Prentice, 2000). As with all other protocols, the spine board is wedged beneath the victim once the side-lying position has been achieved. The rescuers then proceed to roll the victim until he or she has been safely placed on the spine board.

Yet another method calls for a two-step log roll. The first step of this technique does not require the use of a spine board as the victim is rolled from a prone position to a supine position using any of the methods mentioned above. Then, for the second step, a three-, four-, or five-person log roll (as previously described) can be used to complete the transfer of the victim onto the spine board.

The Lift-and-Slide Technique

The lift-and-slide technique has also been described as the six-plus-person lift (Kleiner et al., 2001), the straddle-slide technique (Arnheim & Prentice, 2000), the straddle-lift technique (AAOS-NSC, 2001), and the flat-lift maneuver (Cendoma, 2000). Although this technique is not often put to use, it remains the preferable method for transferring athletes wearing protective equipment (Kleiner et al.; Hafen et al., 1996; Cendoma). By not rolling athletes over their bulky pads (as would be the case with the log-roll maneuver), one can effectively minimize the likelihood of creating unwanted spinal-column movement (AAOS-NSC; Cendoma). In addition, the lift-and-slide technique (or a modified version of it) is also best suited for occasions when very little space is available for the rescuers to complete the log-roll maneuver (e.g., removing patients from cars; AAOS-NSC).

One of the disadvantages of the lift-and-slide technique is that it hinges on rescuer strength (Cendoma, 2000). Furthermore, the lifting involved with this technique poses a threat of injury to the rescuers if improperly performed (Cendoma). Fortunately, these issues can be resolved by using proper lifting techniques and by decreasing the strength requirement for each rescuer by increasing the number of personnel used in the transfer process.

Written descriptions of the lift-and-slide technique reveal that between five and eight people might be required for proper execution (AAOS-NSC, 2001; Arnheim & Prentice, 2000; Cendoma, 2000; Kleiner et al., 2001). A five-person lift and slide requires one rescuer to maintain in-line stabilization, three others to straddle and lift the victim, and a fifth rescuer to slide the spine board into place beneath the victim (AAOS-NSC). Of those required to straddle the victim, one rescuer must be positioned over the chest and shoulders, a second over the hips and thighs, and the third must straddle the legs (AAOS-NSC). On command of the rescuer providing in-line stabilization, the victim must be lifted high enough off the ground to provide space for the spine board to be slid under the victim. It is crucial that the lift itself be coordinated and that while the victim is suspended, his or her head and neck remain in line with the long axis of the body. Once the victim has been lifted, the fifth rescuer can slide the spine board into position either from a position behind the head of the victim (Figure 8a) or from a starting position at the feet of the victim (Figure 8b). Intuitively, steering the spine board from the latter position seems far less challenging, with fewer obstacles (i.e., feet) to contend with. This technique is finally completed when the victim is slowly brought down onto the spine board.
A six-person lift and slide requires a slightly different rescuer arrangement. In this case, the task of lifting the upper torso is split between two rescuers, while one rescuer remains responsible for the hips and pelvis and another for the knees and lower extremities (Figure 9; Arnheim & Prentice, 2000). The rescuers responsible for lifting the upper torso are each required to kneel by the victim’s shoulder with one hand beneath the lateral aspect of the shoulder and the other on the torso just below the level of the axilla. Two other rescuers are required to straddle the victim at the thighs and legs, just as they would with the five-person lift and slide. When ready, the rescuer supporting the head commands the team, initially to raise the victim off the ground and then to gently lower the victim into place on the spine board. Again, the body must be moved as a unit to prevent neurological components from being compromised.

In a recent document released by the National Athletic Trainers’ Association, Kleiner et al. (2001) advocate using what they refer to as a six-plus-person lift, instead of the log roll, to transfer all supine athletes. This technique requires a minimum of eight rescuers. One rescuer is required to stabilize the head and neck, a minimum of six are needed to lift the body (one on either side of the chest, pelvis, and legs), and an eighth rescuer is required to slide the board into position from the foot end. As with all other previously mentioned techniques, the rescuer providing manual in-line stabilization directs all other rescuers to ensure that coordination is maintained throughout the transfer process.

**Conclusion**

Proper management of cervical-spine injuries requires that specific principles of prehospital management be addressed. Stabilization of the head and neck relative to the long axis of the body is critical for the prevention of secondary neurological injury. Furthermore, full immobilization of the spine is necessary to safely transport a patient to an appropriate medical facility. This involves transferring a victim onto a long spine board before transport begins. Although this is not a simple task, it can be accomplished safely using sensible transfer techniques.

Transfer techniques include the log-roll maneuver, the lift-and-slide technique, and numerous variations of the two. Ideally, primary responders should be familiar with, and act with practiced confidence when executing, both types of spine-board transfer techniques. In addition, it is advantageous to familiarize oneself with the numerous variations that are possible for each technique. This, in turn, provides the primary responders with several rescue options. After all, victim positioning, victim size, the number of available personnel, rescuer preferences, rescuer experience level, presence of protective equipment, and space availability are just some of the factors that might dictate which technique should be used.
References


Gianluca Del Rossi is a doctoral student in the athletic training/sport medicine specialization in the Department of Exercise and Sport Sciences at the University of Florida.

MaryBeth Horodyski is an associate professor and director of graduate athletic training in the Department of Exercise and Sport Sciences, as well as director of clinical research in the Department of Orthopaedics, at the University of Florida.

Thomas Kaminski is an assistant professor and director of undergraduate athletic training in the Department of Exercise and Sport Sciences, as well as an athletic training consultant to women’s soccer, at the University of Florida.

Updated and greatly expanded— with new modules that cover all the clinical proficiencies of the 1999 NATA Athletic Training Education Competencies—this third edition of Ken Knight’s popular text is better than ever. In fact, it’s the most flexible clinical education tool available today to athletic training students.

Assessing Clinical Proficiencies in Athletic Training: A Modular Approach, third edition, sports a new title and is organized in an easy-to-use modular format. It now contains 119 clinical modules—including 38 new modules—organized into 21 areas of clinical interest and spread over 4 levels of competencies. Each module contains learning objectives, competencies, and helpful references—plus space for athletic training instructors to record student progress.

The book has these user-friendly features:

• Instructions and an appendix for customizing the book for specific athletic training programs

• Sample questions that provide practical advice on administering oral and practice exams—plus suggested items to include on exams