Tampa Bay EMS Journal
Copyright © 1987 by the Acute Care Foundation
Volume 1, Number 2
October-December, 1987

Errors in Anti-Shock Trouser Application: A Suggested Method of Placement

MICHAEL BROWN, REMT-P

In 1983, the Training Division of the Hillsborough County Department of EMS conducted trauma scenarios as a training and evaluation exercise. The scenarios were videotaped for later review by the participating EMT's and paramedics. Each group participated in two scenarios; one being a single vehicle accident and the second being a pedestrian, cyclist, gunshot wound, knifing or fall accident victim. Each crew was required to evaluate and treat within certain groundrules established before the exercise. Every patient in the exercise had exsanguination trauma with initial or slightly delayed hypotension and hence, was an appropriate candidate for the application of anti-shock trousers.

During these training exercises, approximately sixty applications of anti-shock trousers were videotaped. A pattern of errors and difficulties in application of the garment was appreciated. These included both overt errors of application and problems of application seemingly inherent to the methods used. There were no fully correct applications of the anti-shock trousers observed in any of the exercises. These errors were excessive mobilization of the patient during trouser placement, placement of the anti-shock trousers too low on the abdomen, and inadequate tension on the abdominal binder.

DESCRIPTION OF APPLICATION METHODS

Descriptions of anti-shock trouser application methods are almost exclusively confined to prehospital care textbooks and manufacturer's product literature. Even these sources are meager, leaving the specific details and methods of application to be invented by the user. The most frequently described method is the log roll application. Another method is simultaneous extrication application. A third common method, with multiple variations, is the trouser slide-on application. The *Prehospital Trauma Life Support* text discussion of this issue is limited to, "Application of the pneumatic anti-shock garment is seldom a problem for the experienced EMT" (1). The *Basic Trauma Life Support* text description is simply, " Unfold the trousers and lay them flat along the spineboard or the stretcher. Maintaining immobility of the spine, place the patient on the stretcher so that the top of the garment is just below the lowest rib" (2). The *Advanced Trauma Life Support* text for physicians describes the procedure as, " Unfold trousers and lay flat on the long spineboard. Carefully slide trousers with the spineboad under the patient, maintaining immobility of the spine" (3).

The most commonly utilized method of placing anti-shock trousers is the log roll application. This is performed by first log rolling the patient onto their side. The garment, usually atop a backboard, is then brought next to the patient. The patient is then rolled back onto the the garment. Use of this method requires sufficient space and personnel to properly execute the log roll.

Simultaneous extrication application combines the process of sliding the patient onto a backboard with anti-shock trouser placement. With this method, the garment is first secured to a backboard. The patient is then slid axially onto the backboard/trouser combination. The garment must be placed on the board so that when the patient is fully extricated, they will also be correctly approximated atop the garment. The method is probably the most time efficient.

The trouser slide-on is a seemingly uncomplicated technique. The garment, with the leg sections loosely assembled, is slid into place over the feet just like a pair of trousers. A variation involves folding the anterior portion of the leg sections together, sliding the garment under the legs and pelvis. Unfortunately, the pelvis and low back must be elevated in order to move the abdominal section of the garment into place. As such, this method is unsuitable for anti-shock trouser placement in cases of possible spinal or pelvic girdle trauma. This method can also be quite awkward with large or heavy patients.

SCENARIO OBSERVATIONS

Only two techniques for anti-shock trouser application and their variants were observed during the scenarios. The most frequent method was the log roll application. The least common observed method was the trouser slide-on application. During the exercises, we did not observe any participants perform the simultaneous extrication application. Because this was not originally intended as a formal investigation, the videotapes were reused. Therefore, strict empiric data was not gathered.

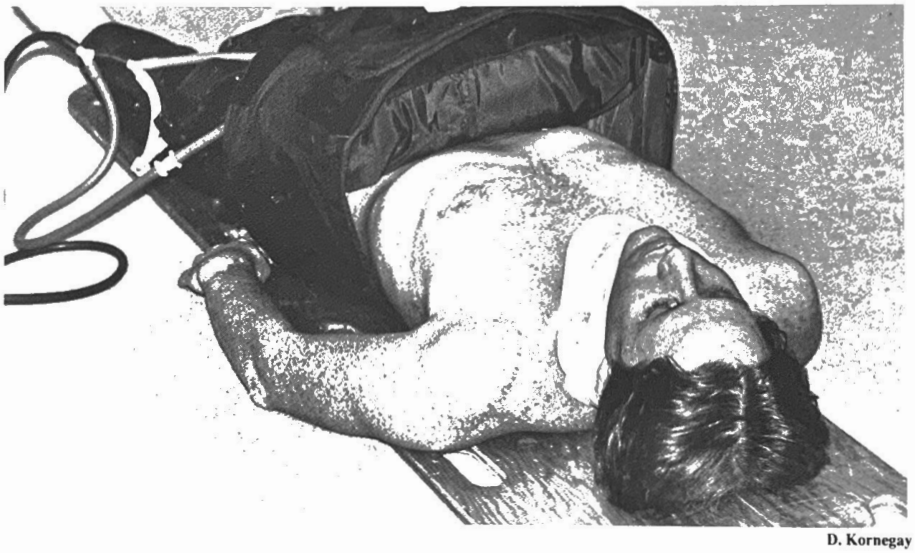
Senior Paramedic, Hillsborough County EMS; Contributing Editor, Tampa Bay EMS Journal; Tampa, Florida

Excess movement of the patient was seen in most applications. The most grievous error observed was associated with the trouser slide-on application, when the pelvis was elevated to accommodate placement of the abdominal binder. Log roll application was frequently associated with excessive movement of the spine, pelvis and lower extremities. Technical errors in log rolling accounted for much of the inadvertent movement. There errors were usually from poorly coordinated movements, insufficient number of personnel, and cramped or otherwise unfavorable surroundings. Less frequently, movement occurred during attempts to adjust the garment when the initial application did not provide proper positioning.

Low garment placement on the abdomen was a nearly universal observed application error. Placement was usually at or below the level of the umbilicus. This problem seemed to be common to all trouser slide-on applications. It was exacerbated by larger body weights, regardless of the method used. Low placement of the abdominal section results in a reduced area of circumferential counterpressure over the abdomen. Good placement of the trousers next to the body rarely occurred with the log roll application. It was often accompanied with rotational mispositioning of the garment.

An unexpected finding was the effect of abdominal tension on the shape of the balloon. When the abdominal balloon is inflated against a loose binder, the balloon expands into a roughly cylindrical shape. This reduces the cross-section of circumferential counterpressure into a narrow band across the mid-abdomen (Figure 1). High initial binder tension retains the the flat shape of the balloon and thereby maximizes the area of abdominal counterpressure (Figure 2). Tightly wrapping the abdominal and leg binders has an additional advantage of reducing the required air volume and hence, the time to inflate to the desired pressure.

Figure 1 - Loose Abdominal Binder - The loose abdominal binder allows the balloon to expand into a cylindrical shape with only a narrow band of contact against the abdominal wall.



D. Kornegay

D. Kornegay

Figure 2 - Tight Abdominal Binder - A tightly applied abdominal binder applies pressure against a large portion of the abdominal wall, maximizing the counterpressure effect.

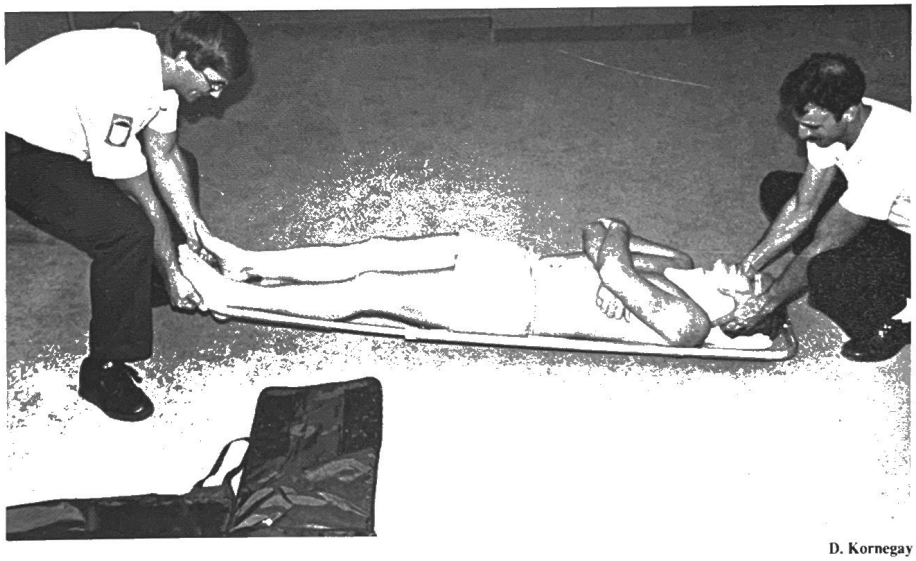
ORTHOSCOOP APPLICATION

Subsequent to the exercises and tape reviews, options for anti-shock trouser application were explored that attempted to address the observed error patterns and the inherent problems of the application methods. An ideal technique for placement on a trauma patient should require no more than two persons, have no potential for movement of the spine or pelvis, allow high correct abdominal placement, and be rapidly accomplished. A method to meet these standards was developed utilizing the orthoscoop (orthopedic split frame stretcher). This method has been adopted into the *Hillsborough County Department of Emergency Medical Services Standing Orders and Protocols* since 1984 and is the required method for trauma cases. It is introduced here as an alternative to the traditional techniques.

For the orthoscoop application, the patient is first "scooped" and the foot end elevated slightly (Figure 3). The garment is then positioned under the orthoscoop and the abdominal balloon and anterior portions of the leg sections are pulled between the leg sections of the stretcher (Figure 4). If the abdominal balloon is part of the binder, then only the anterior of the leg sections are pulled between the legs. The abdominal balloon and leg sections are laid in place (Figure 5). The abdominal balloon and binder should be gently pulled superiorly to insure sufficiently high abdominal placement. Lastly, the orthoscoop is lowered, removed and the garment wrapped tightly around the legs and abdomen (Figure 6).

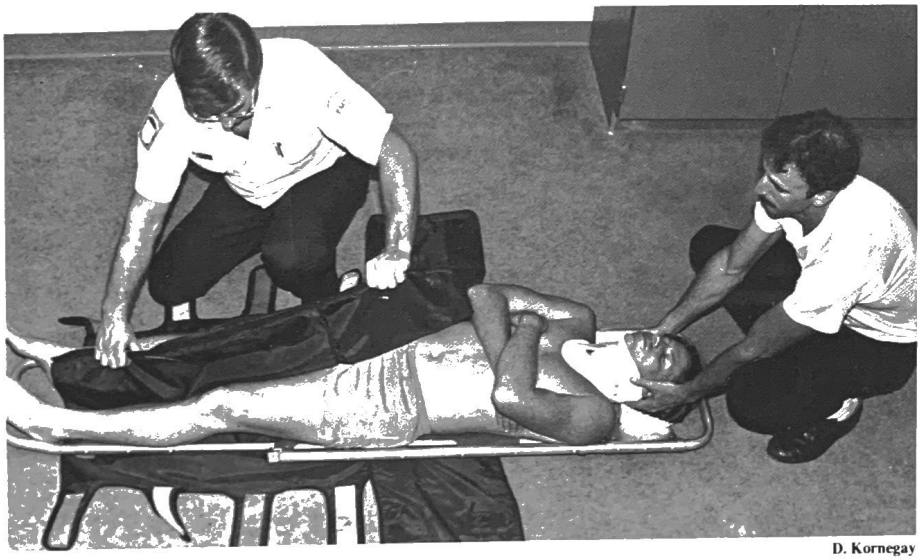
DISCUSSION

There has been considerable attention given in the literature to the physical effects, complications, and more recently,



D. Kornegay

Figure 3 - Elevation of Patient - The patient is immobilized in the scoop and the foot end of the stretcher is raised to allow positioning of the MAST.



D. Kornegay

Figure 4 - Pull Front of Leg and Abdominal Sections Anteriorly - The bladder sections for both legs and the abdomen are pulled up between the patients' legs and the halves of the stretcher.

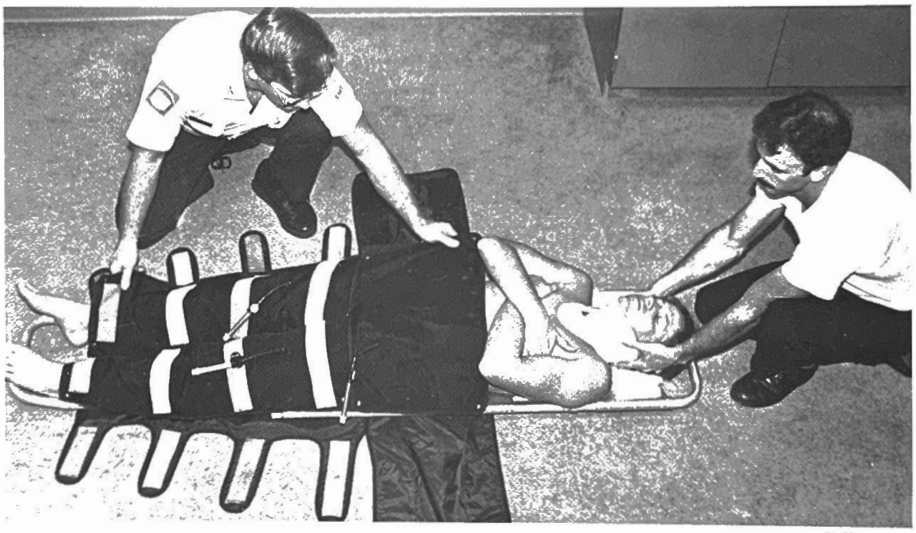
the clinical efficacy associated with anti-shock trousers. However, there is a paucity of information dealing with the mechanics of application. The variability of the emergency environment demands that a variety of sound techniques be available.

Log rolling with suspicion of cervical injury requires four persons to properly execute (4). Log rolling for anti-shock trouser application ideally requires a fifth person to position the garment and backboard. It should be noted that log rolling has some inherent problems. It requires careful coordination of all persons involved in the procedure. Further, log rolling appears to assume that the torso is cylindrical, when indeed it is not.

Orthoscoop application appears to avoid many of the the problems of multiple person coordination, log rolling, and garment positioning. However, the safety of the orthoscoop stretcher has been questioned for cases of suspected spinal injury. These concerns may have been directed at some models of orthoscoops without rigid head support. Models with rigid head support should only be used. The lack of direct midline support of the spine is another concern. This objection assumes that the spinal column and adjacent anatomy are a loose mosaic (1). These issues have not been well studied in the literature. The author disagrees with the loose mosaic criticism because it conflicts with the fundamental concept of splinting, where support of surrounding structures will support interconnected skeletal structures.

CONCLUSIONS

A study of videotaped trauma scenarios revealed a pattern of errors in the standard application of anti-shock trousers. The several distinct methods of application are



D. Kornegay

Figure 5 - Lower Stretcher and Spread Out Bladder Sections - The foot end of the stretcher is lowered back down and the bladder sections are spread out in preparation for velcro fastening.

D. Kornegay

Figure 6 - Split Stretcher and Fasten Velcro - The two halves of the stretcher are separated at the foot end to allow the velcro fasteners on the MAST sections to be tightly joined. The stretcher halves may be rejoined in preparation for movement. Inflation may proceed when appropriate.

formally described. A new method is introduced which utilizes the orthopedic split frame stretcher. This method appears to avoid many of the pitfalls of other techniques. This investigation also identifies several areas in spinal immobilization that should receive further study.

REFEREE COMMENTARY

Alexander Rosemurgy, MD (Director, Trauma Center, Tampa General Hospital; Assistant Professor of Surgery, University of South Florida; Tampa, Florida) - Though debate over the efficacy of MAST exists, there is even less consensus in the optimal method of placement. This often ignored subject is well covered here. I strongly support the conclusions drawn and the implementation of them in training programs and daily field use. The areas identified should receive further study.

Charles Anderson III, REMT-P (Paramedic, Palm Harbor Fire Department, Pinellas County EMS) - Most people involved in the prehospital and emergency care of the trauma victim may readily empathize with the difficulties and pitfalls of MAST garment application as evidenced by Mr. Brown's study. I most certainly can.

I believe that Mr. Brown has accurately described the three most common methods of application in current use and has illustrated a new and credible technique of application as well. While the log roll method has long been the standard, this does require the greatest number of personnel to execute properly. The simultaneous extrication application method is clearly the best method for use in the entrapment/extrication scenario provided that there is a reliable method used to secure the MAST to the spine board. The trouser slide-on technique, in my opinion, should not be considered in a trauma setting and should be limited to use in treatment of certain medical maladies (i.e. aneurysm, GI bleeding). The orthoscoop method appears to support the old adage that necessity is the mother of invention. It utilizes minimal personnel (perhaps a scarce resource in multi-casualty incidents) and takes very little time to perform properly. The only major drawback to this ingenious idea seems to be with the lack of data in support of sufficient spinal immobilization. Perhaps other situations such as uneven surfaces or patient position might indicate other methods. Until the risk/benefit factors of this method are further studied, it would be wise to utilize a conservative approach in view of this procedure. I personally have high hopes for the acceptance of this technique by the medical community and its subsequent addition to packaging protocols for trauma patients should proper spinal support be substantiated.

Mr. Brown's response - Half the emphasis in this article dealt with errors seen during anti-shock trouser application by accepted methods. As stated, there were no flawless applications during the trauma scenarios. In an ergonomic approach to technique design, built-in avenues to errors should be avoided. My contention is that the accepted techniques are replete with opportunities for human error or less than optimal performance. Orthoscoop application appears to avoid most of the critical actions that are subject to performance error.

It appears the subject of spinal immobilization and anti-shock trouser application is highly dogmatic and has not received the scientific scrutiny it deserves. Note the relative lack of available text describing any method of anti-shock trouser application. While the efficacy and safety of spinal support with the orthopedic split frame stretcher has not been established, neither has the efficacy and safety of backboards and log rolling been established. The human back is not a geometric plane as is the backboard. Theoretical arguments dissuading use of the orthoscoop could as readily be asserted against the backboard.

Obviously, log rolling will always be a necessary technique in the handling of injured persons as there is no other way to return a person in an unusual position to the position of function. However, as logrolling is also of unproven safety, then one can argue that avoidable or repeated logrolling not be utilized.

BIBLIOGRAPHY

1. Butman AM, Paturas J, McSwain N, Dineen JP (Eds.): *Prehospital Trauma Life Support*. Emergency Training, Inc., Akron, OH, 1986.
2. Campbell JE: *Basic Trauma Life Support*. Brady Communications, Bowie, MD, 1985
3. Trunkey DD (Ed.): *Advanced Trauma Life Support Course for Physicians - Student Manual*. American College of Surgeons, Chicago, IL, 1984
4. American Academy of Orthopedic Surgeons: *Emergency Care and Transportation of the Sick and Injured*. Fourth Edition, ORCO, Inc., Park Ridge, IL, 1987.