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Tampa Bay EMS Journal

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Thomas Jeffery, REMT-P
*Senior Paramedic
Hillsborough County EMS*

David Pecora, REMT-P
*Senior Paramedic
Hillsborough County EMS*

Patrick Shepler, REMT-P
*Clearwater Fire Department
Pinellas County EMS*

Thomas Gow, REMT-P
*Assistant Training Officer
Manatee County EMS*

Kimberly Pierson, RN, REMT-P
*Education Department
St. Anthony's Hospital*

Gregory Thomas, REMT-P
*Paramedic Supervisor
Manatee County EMS*

Robert Wilbur, REMT-P
*Mercer University School of Pharmacy
Pinellas County EMS*

Mark Wood, REMT-P
*Palm Harbor Fire Department
Pinellas County EMS*

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Development of a Medical Operations Manual for the Pinellas County EMS System

MICHAEL R. GUNDERSON, REMT-P₁, and PATRICK SHEPLER, REMT-P₂

Establishing or revising prehospital EMS treatment protocols, a term we will consider inclusive of standing orders and standard medical operating procedures, provides a system with the opportunity to make significant changes in its field operations and medical control programs. The following paper will outline the philosophy and process used for a major protocol revision in the Pinellas County EMS system. This paper represents our review and comments in hopes of further improving the protocol revision process. This experience may be useful for other systems to consider in similar efforts.

Pinellas County EMS is a county-wide taxing authority and administrative resource to a metropolitan EMS system with seventeen first response ALS agencies and three ALS ambulance response agencies. This system directs the actions of approximately 385 paramedics and hundreds of additional EMT's under the control of a medical director and two associate medical directors retained by the EMS authority. In 1986, Pinellas County EMS responded to over 68,000 emergency calls.

Many problems in earlier editions of the Pinellas protocols were probably a result of the way in which the system had developed. Prior to the county-wide system, EMS providers functioned independently within their own districts. Approximately 30% of the County was then without ALS coverage. The quality of care varied considerably. Following successful passage of a referendum to create the county-wide EMS authority, an effort was made to provide a county-wide standard of care. The number of ALS provider agencies grew from twelve to twenty. Due to this rapid growth and persisting lack of a county-wide continuing education program, there was and still is considerable difficulty providing educational programs or materials in an appropriate fashion throughout the system. Consequently, previous protocols became instructional documents with directions on how to perform procedures, rather than becoming a set of concise clinical policy guidelines. For many paramedics, the protocols were their only encounter with medical control, aside from radio contact with the receiving emergency department physician.

After their original implementation, the protocols expanded from time to time, but often at the sacrifice of clarity and consistency. For example, reprints were included that recommended drug dosages in conflict with the protocols to which they were attached.

Many of the paramedics had developed dissatisfaction with the protocol document. In March of 1986, the authors of this article, both field paramedics, made a formal proposal to the medical directors for an extensive revision effort. The proposal outlined rationale for a new style and format that would attempt to clarify objectives and remove many of its inconsistencies and ambiguities that had developed over the years. A draft set of reformatted protocols were submitted by the authors using the proposed format as illustration of how they might appear in final form. Shortly after that proposal was submitted, a protocol subcommittee was formed by the Pinellas Advanced Life Support (PALS) group. The protocol committee has delegates from many of the fire department first response agencies and ambulance companies, including several field paramedics.

The philosophies and format contained in the original proposal were presented to the committee. This was followed by considerable debate and modification, but the key elements of the proposal were retained.

PROTOCOL PHILOSOPHY

The protocol committee engaged in a rather extensive series of debates regarding the philosophy that would be most appropriate to the document. One of the first issues in these debates led to an agreement that protocols cannot and should not be viewed as a remedy for all medical control and training problems. The protocols should be considered as but one component of a prospective medical control program. Further, the protocols must make some realistic assumptions about the clinical expertise and competency of its field paramedics. Pinellas County EMS, probably not unlike most other agencies, has a wide spectrum of clinical competency amongst its field personnel. Without immediate means to upgrade those at the lower end of this spectrum, it was necessary to aim the degree of clinical latitude in the field towards a lowest common denominator. As training improves, this factor may be adjusted appropriately in future revisions.

The second major issue in these early protocol philoso-

1 Senior Consultant, Emergency Medical Resources, Inc., Paramedic, Palm Harbor Fire Department, Pinellas County EMS, President, Acute Care Foundation; Tampa, Florida

2 Paramedic, Clearwater Fire Department, Pinellas County EMS, Board of Trustees, Acute Care Foundation; St. Petersburg, Florida

phy debates lead to the conclusion that the protocols should not be teaching documents. They should instead be concise clinical guidelines which specify what procedures may be performed under given sets of circumstances. Training was a separate issue and needed its own solutions apart from what the protocols might offer. It was also recognized that a protocol can not be written for every possible combination or permutation of clinical circumstances. The trauma patient with a cardiac history and instances where one dysrhythmia converts to another are just some examples that do not fit in any one protocol. The clinical judgement of the paramedic must be used to successfully integrate and tailor care for specific patients. Physician consultation is encouraged, but we recognized that it isn't always practical or immediately available when a decision must be made.

The third major issue concerned the format in which each protocol should be presented. The debate established that each protocol subject would provide both adult and pediatric sequences. The adult sequence would be immediately followed by the pediatric sequence. Despite the redundancy in this approach, it seemed to be advantageous over the potentially complicated conditional statements in the original proposal that considered age and/or body size with a single treatment sequence. The format of both the adult and pediatric sequences were divided into two sections, fitting the way in which paramedics must operate in the field. Part I has actions authorized prior to physician contact and Part II consists of actions to anticipate or request with physician contact. This eliminated previous ambiguity over where such lines were drawn. However, considerable debate ensued over a proposed Part III section in which selected or alternative items from Part II may be carried out if physician contact was not possible or practical. This formatting was based in part on protocols published on the Hillsborough County EMS system (1). The Part III section was dismissed in favor of adopting a policy in which paramedics may initiate Part II orders independently, but must make explicit justification of those decisions in their run reports. Any run reports with paramedic initiated Part II orders or other protocol deviations will be flagged to receive special audit by medical control. This puts an additional emphasis on the need for quality documentation by field personnel and thorough audit procedures by medical control.

As a final preliminary step, the protocol committee reviewed the previous standing orders and those from other systems in its consideration of a table of contents. The items included in the new table of contents (Table 1) were separated into four sections - I. Administrative Protocols, II. Treatment Protocols, III. Procedure Manual, and IV. Drug Summaries.

The Administrative Protocols, Part I, cover issues such as transport destination protocols and on-scene medical command.

Treatment Protocols, Part II, include the working diagnosis and/or symptom based procedures for field care.

The Procedure Manual, Part III, was created to fill a limited need for instructional resources in this document. The introduction of the protocol document states the intent to avoid a role as an educational resource. Instead, the system would adopt texts listed in Table 2 as standard references. However, there are areas in which these standard resources conflict with each other, offer more than one method for a specific technique, or do not include procedures or policies for items the protocol committee wanted to include in the document. The procedure manual was designed to provide an educational reference for such cases. It includes discussions on local legal issues with clinical procedures for blood alcohol sampling, use of aerosolized bronchodilators, and clarification on titration of supplemental oxygen therapy with COPD patients and many other topics.

The Drug Summary section, Part IV, provides a concise description of each drug and how it is to be used specifically in the Pinellas system.

METHODS

Once these preliminaries were resolved, the work of writing drafts for each section were divided amongst the protocol subcommittee members. Each draft was to consider the standard resource texts, review of other specialized texts, recent articles in medical journals and similar protocols from other systems. In several cases, computerized searches of a medical literature data base (Medlars) was made to assist in getting the most contemporary information or to attempt to resolve controversies on specific items. The intent was to build a set of protocols based on published and referenced medical literature. The validity of the protocol then has a verifiable basis in the event of any litigation that might take issue with the protocols themselves. Further, it sets a valuable precedent that a protocol revision in this system must have a solid basis in published medical literature rather than just the opinions of the medical directors without external verification. It should compel the system to make careful review of the medical literature.

As each first draft was presented at protocol subcommittee meetings, it was subjected to very intense peer scrutiny. This process seemed to be a bit awkward at times for the person presenting the draft. However, it established an open attitude for constructive criticism. This was a crucial part of our protocol development process. After the first several drafts were reviewed, a consensus and understanding amongst the committee quickly developed that encouraged a very brief and concise format and allayed the apprehensions of those presenting the first drafts. The constructive feedback of the committee was used to write the second draft for each protocol.

To avoid frequent redundancies in each protocol with primary and secondary survey, ECG monitoring, IV lines,

Table 1 - Table of Contents for the Pinellas County EMS Medical Operatons Manual

Section I. ADMINISTRATIVE PROTOCOLS		
A. Intent and Use of Protocols (Ver. 121886)		I.A
B. On-Scene Medical Control (Ver. 020587)		I.B
C. Transport Protocol (Ver. 030287)		I.C
D. No-Code Orders and Discontinuance of CPR (Ver. 121886)		I.D
Section II. TREATMENT PROTOCOLS		
A. Supportive Care		
1. General Supportive Care (Ver. 121886)		II.1
2. Trauma and Hypovolemic Supportive Care (Ver. 121886)		II.2
B. Cardiopulmonary Protocols		
3. Airway Obstruction (Ver. 121886)		II.3
4. Asthma (Ver. 030287)		II.4
5. Asystole (Ver. 121886)		II.5
6. Atrio-Ventricular Block (Ver. 121886)		II.6
7. Bradycardia (Ver. 121886)		II.7
8. Chest Pain - Suspected AMI (Ver. 121886)		II.8
9. CVA/TIA (Ver. 121886)		II.9
10. Electromechanical Dissociation (Ver. 121886)		II.10
11. Emphysema (Ver. 030287)		II.11
12. Hypertensive Emergencies (Ver. 121886)		II.12
13. Cardiogenic Shock (Ver. 020587)		II.13
14. Premature Ventricular Ectopy (Ver. 121886)		II.14
15. Pulmonary Edema (Ver. 121886)		II.15
16. Supraventricular Tachycardia (Ver. 121886)		II.16
17. Ventricular and Supraventricular Tachycardia with Wide QRS and Pulse (Ver. 030287)		II.17
18. Ventricular Fibrillation and Pulseless Ventricular Tachycardia (Ver. 121886)		II.18
C. Other Medical Protocols		
19. Acute Abdomen (Ver. 121886)		II.19
20. Anaphylactic Reactions (Ver. 030287)		II.20
21. Behavioral Disorders (Ver. 121886)		II.21
22. Coma - Unknown Etiology (Ver. 030287)		II.22
23. Diabetic Emergencies (Ver. 030287)		II.23
24. Drug Overdose/Poisoning (Ver. 121886)		II.24
25. Heat Emergencies (Ver. 121886)		II.25
26. Obstetrical Emergencies (Ver. 121886)		II.26
27. Seizures and Status Epilepticus (Ver. 121886)		II.27
28. Syncopal Episodes (Ver. 121886)		II.28
D. Trauma Protocols		
29. Bites and Stings (Ver. 121886)		II.29
30. Burns (Ver. 121886)		II.30
31. CPR - Traumatic Etiology (Ver. 121886)		II.31
32. Head and Spinal Injuries (Ver. 121886)		II.32
33. Near Drowning (Ver. 121886)		II.33
34. SCUBA Accidents (Ver. 121886)		II.34
Section III. PROCEDURE MANUAL		
1. Baker and Meyers Act (Ver. 121886)		III.1
2. Blood Alcohol Sampling (Ver. 020587)		III.2
3. Controlled Drug Records and Disposal (Ver. 121886)		III.3
4. Cricothyroid Airways (Ver. 121886)		III.4
5. Child, Infant, Neonate, Pediatric and Adult - Clinical Definitions (Ver. 121886)		III.5
6. Infectious Diseases (Ver. 121886)		III.6
7. Intubation Methods (Ver. 121886)		III.7
8. Mechanical CPR Devices (Ver. 121886)		III.8
9. Aerosolized Bronchodilator Technique (Ver. 121886)		III.9
10. Neonatal CPR (Ver. 121886)		III.10
11. Oxygen Tolerance in COPD (Ver. 121886)		III.11
12. Vagal Maneuvers (Ver. 030287)		III.12
13. Ventilatory Assistance (Ver. 121886)		III.13

etc., two special protocols were developed for standard medical and trauma packaging - the General Supportive Care protocol and the Trauma and Hypovolemic Supportive Care protocol, respectively.

General Supportive Care outlines steps that may be taken to "package" a patient with non-hypovolemic medical emergencies. It includes establishing an airway, supplemental oxygen, ECG monitoring, and an IV of D5W. The paramedic is allowed a latitude to apply as much or as little of this protocol as is appropriate for a given situation, subject to on-line review with the receiving physician and retrospective review by medical control.

Trauma and Hypovolemic Supportive Care outlines packaging for trauma patients as well as those suffering from non-traumatic causes of hypovolemia (i.e. GI bleeding, aneurysm, severe vomiting and diarrhea). It includes lactated ringers solution for the IV lines and measures for spinal immobilization. The latitude given to the paramedic does not mandate that a case with significant hypovolemia secondary to heat exhaustion has to have cervical immobilization if the circumstances (real or potential) do not call for it.

Following completion of all the second drafts, they were sent to the medical directors and, in some cases, to consulting specialty physicians at area hospitals. The comments of both groups were deliberated by the protocol subcommittee and incorporated into the third draft.

The entire document was then reviewed as a whole with final changes made in formatting, spelling, grammar, etc. for production of the fourth and final draft. This fourth draft was submitted to the medical directors for their final deliberations, modifications and approval.

The completed document, entitled the "Medical Operations Manual," was published and distributed in April of 1987.

IMPLEMENTATION

With a completed and approved new protocol, the problem of providing inservice training on the document to the twenty EMS provider agencies in Pinellas County remained. Various alternatives were considered before a decision was made to conduct a one day seminar, devoted exclusively to the Medical Operations Manual. The seminar would be open to all paramedics, EMT's, EMS supervisors, and emergency department personnel in the County. Arrangements were made with Suncoast Hospital for a lecture hall, AV equipment, and refreshments. A faculty was assembled which included the Medical Director, the Associate Medical Directors, the County EMS Administrator and members of the Protocol Committee.

One third of the field personnel would not be able to attend because they would be on-duty. Payment of overtime for attendance of off-duty personnel is beyond the control of

the County EMS authority. This made any projection of the attendance by field personnel difficult. Therefore, the seminar was videotaped and made available to each EMS agency in the County.

PROTOCOL AND VIDEOTAPE MAINTENANCE

The multiple step process of repeated and on-going drafting and revision of the document is made considerably easier by a word processor. The formatting within the word processor is an important consideration. Appropriate formatting can minimize disruption of page breaks and page references in a table of contents. Independent numbering of pages within sections and starting new sections on a new page can be very helpful. Make careful checks for typographic and spelling errors. Some word processors can assist with this task, but do not neglect careful proofreading. To keep track of revisions, the table of contents should show the date of the latest revision for the document as a whole and the latest revision dates for each section. The bottom of each page should have the latest revision date for that particular section. This will allow any copy of the document to be checked for updates by comparing the latest table of contents with the dates in each section.

When a protocol undergoes major revision, the corresponding segment of the videotape may be updated as well. The videotape is a resource for refresher training and orientation of new personnel. The new segment may be edited into the master tape and new copies generated over the old ones.

Table 2 - Standard Pinellas EMS Reference Texts

General Care:
Caroline N: Emergency Care in the Streets. 2nd Ed., Little, Brown & Co., Boston, 1984.
Cardiac Care:
American Heart Association: Standards and Guidelines for Cardiopulmonary Resuscitation (CPR) and Emergency Cardiac Care (ECC). Journal of the American Medical Association 255: 2905-2989, 1986.
American Heart Association: Textbook of Advanced Cardiac Life Support. Dallas, 1983.
Trauma:
Campbell JE: Basic Trauma Life Support. Prentice-Hall, Englewood Cliffs, NJ, 1985.

DISCUSSION

The most effective part of our protocol development process was the open debate amongst the committee members. This must be done in an environment that encourages constructive criticism. It would seem advantageous in these sessions to present proposals and alternatives in treatment that are a bit unconventional or previously not considered to be a part of field EMS care. This encourages the debate to include serious consideration for a wider range of possibilities and potential innovations. For example, many of our committee members had initially rejected the idea of inhaled bronchodilators as an alternative to intravenous agents. Their skepticism seemed to be on the basis that it was very different from what we had done in the past and that medical director acceptance would be unlikely. However, the use of inhaled bronchodilators was finally accepted by the medical directors on the basis of our presentation of clinical rationale, supporting research literature and positive opinions from consulting specialty physicians.

The consultation of specialty physicians was extremely valuable. It must be recognized that any EMS medical director has very limited exposure to developments in all areas of critical care medicine, even under the best of circumstances. One of the best sources of information and critique are the specialists who deal with critical care problems in their particular area of expertise on a day to day basis. Based on our experience, the participation of specialty physicians should be sought in as many protocols as possible. We had sent each of the consulting specialty physicians the entire protocol package with a cover letter that explained what areas we would like them to address. It was important to send the entire package so that the items the specialists would consider could be put in proper context. Their responses to the committee were in the form of telephone conversations and notes written on copies of the document itself. In future efforts, each consulting specialist should be encouraged to present their findings to the committee in person. This would provide an opportunity to more thoroughly discuss the treatment options and controversies. The consulting specialists should also be asked to provide bibliographic citations whenever possible in support of any specific recommendations. The citations will give the protocol document a better medical/legal foundation in the event of any litigation. This was done to only a limited extent in these protocols. Further revisions should include a more complete bibliography.

It may be appropriate in many cases to have more than one specialist provide comments on the same protocol. An added benefit to specialty physician participation was the chance to educate them about our EMS agency, its protocols, and the professionalism we are striving for in our medical operations. Support amongst the attending physicians of the community is extremely valuable to any EMS system.

Another part of our protocol revision process utilized

two computer information networks, CompuServe® and Mnetics Videotex®, to access medical special interest groups. These electronic communications networks include thousands of clinicians around the U.S. and abroad linked together via telephone modems and personal computers for the exchange of ideas and information. The networks also facilitate access to various medical data bases and on-line libraries. Several of the Pinellas County protocols and specific questions about treatment modalities were presented in these computerized medical forums. This feedback had provided the committee with excellent information from other specialists, emergency physicians and paramedics across the U.S and Canada. This resource should be used to a greater degree in future efforts. In lieu of face to face meetings, an on-line conference with several parties across the country or locally may be easily facilitated via the computer network.

The format of the protocols draw a line between what may be done with and without physician consultation. This line should be drawn on the basis of the difficulty in clinical decision making and risk/benefit ratio for each step. The overall clinical skill of the paramedics, their continuing education and medical control support programs should weigh heavily in deciding what the independent clinical decision making capability of a systems paramedics are. The fragmented nature of the Pinellas County EMS system, with eighteen ALS provider organizations and three private ambulance companies, makes skills evaluation, continuing education and medical control extremely difficult. Consequently, the lines where physician consultation is sought are set conservatively. However, as this system develops better evaluation, education and medical control programs, these lines may become a bit more liberal. There may be a possibility for individual paramedics or provider agencies within the system to obtain more clinical privileges based on favorable clinical evaluations and educational program participation. This could be an incentive used by a system to encourage higher levels of clinical performance, documentation and continuing education.

Considerable thought and debate led to the format and consensus in philosophy of the Medical Operations Manual. In the months since its implementation, some revisions have already been made. However, any substantial change to a protocol should undergo the full process academic scrutiny, debate and bibliographic research. There will be temptation to modify protocols in response to problems are not with the protocols, but are related to poor protocol orientation, continuing education or other medical control procedures. Disrupting the format and philosophy of the protocols not only weakens the document, but usually fails to solve the immediate problem. Protocols are only one of many parts of a medical control program with prospective, on-line, retrospective and feedback components.

A program to monitor the medical literature for potential

protocol innovations would be desirable and could form the basis for an EMS research program.

SUMMARY

Protocols are a single component of a medical control program. They have a dramatic effect on the way in which care is delivered in the field. It is appropriate and beneficial to have selected field paramedics participate with their medical directors and specialty physicians in the protocol development and revision process. A major revision of the Pinellas County EMS protocols utilized paramedics as the primary authors of protocol drafts which were then subjected to specialty physician commentary. The EMS system medical directors were then presented a protocol draft supported by field paramedic input, medical literature references and the comments of consulting medical specialists. This established a valuable precedent in our system for future protocol revision efforts. Maintaining and improving the precedent of academic and clinical quality is an important responsibility of the protocol committee. By establishing a structured framework which includes the most current standards of field care, the system has a state of the art set of protocols that provide the system and its medical directors with considerable protection against litigation. This entire process may be useful to other prehospital EMS systems considering protocol development and revision issues.

REFEREE COMMENTARY

William Minix, M.D. (Associate Medical Director, Pinellas County EMS; Emergency Department, Palms of Pasadena Hospital) - The authors do an excellent job of describing development of the current M.O.M. (Medical Operations Manual) of the Pinellas County EMS System. Hopefully, this will aid other systems in their efforts to standardize and improve their protocols.

In a larger perspective, this collaboration between paramedics and physicians to produce a unified and enlightened approach to pre-hospital management is reflective of a healthy recognition of the importance of the paramedics' unique perspective and facility in dealing with these most critical patient situations.

The professionalism of paramedics in this system is enhanced by the uniform and county-wide nature of these protocols as well as the rigorous approach of requiring multiple physician input and bibliographic citation, which will be expanded in subsequent revisions.

Finally, paramedics in this county are in a unique position to function in what is rapidly becoming a "state of the art" system. They are being called upon not only to assimilate innovations such as a trauma center, helicopter and new standing orders, but also to become an integral participant to "complete the feedback loop" by keeping medical control informed of how the standing orders are actually working in the field, how they can be better implemented, and how they can be improved.

Vaughn Whitehead, BA, REMT-P (Senior Paramedic, Hillsborough County EMS; Instructor, Hillsborough Community College) - EMS protocol development is an arduous but absolutely essential process for any prehospital EMS system. Having been involved with the protocols for Hillsborough County EMS since their inception in 1977, I am well aware of the plethora of problems inherent in their creation.

EMS is no longer the proverbial "babe in the woods," so reviewing protocols from other systems can prevent reinvention of the wheel.

Prior to the first words being written, the format and scope of the protocols must be determined. I believe it is a mistake for any protocol to attempt to address all situations. A certain amount of leeway must be left for discretionary treatment by the paramedic. Also, no protocol manual should attempt to be a training manual except when certain procedures need to be defined. A paramedic should not have to be reminded how to intubate by reading the protocols.

The use of committees for creating and review of each draft will provide a well rounded and error free document. Using few viewpoints will result in a protocol that will require rewriting in a very short time.

Since a treatment protocol manual is a medical/legal document, referencing is, for obvious reasons, mandatory.

It is obvious that Pinellas County has made an exemplary attempt to avoid the many pitfalls inherent in the production of medical protocols, and I commend you.

Francis E. Toscano, M.D. (Emergency Department, Morton Plant Hospital) - Paramedic protocols exist in nearly every city in the United States. Usually they are written by the medical director of the EMS system with input from physicians who specialize in emergency medicine, cardiology and trauma surgery. The protocols are then dictated to paramedics who are intimidated by the "expertise" of these authors and are forced to accept algorithms that can, at times, prove unworkable in the field.

The protocols described in this paper may prove to be far more practical, simply because they are written by paramedics who understand intimately the problems inherent in executing a complicated algorithm in the street.

The easy way to develop EMS protocols is to write the EMS directors of several major cities and request copies of their own protocols already in use. A few minor alterations here and there and, presto, you have new protocols. The method described by the authors of referring to the primary sources is far more painstaking but also far more valid. Their concern with litigation is a valid one. In today's legal climate, the county EMS system represents a very deep pocket waiting to be tapped by dissatisfied patients. The method by which these protocols were generated may help protect the County in some future litigation.

I congratulate the authors for reporting in detail their methods. Other EMS systems would be wise to follow suit. I now anxiously await the opportunity to view the results, the protocols themselves.

Mr. Gunderson's Response - I appreciate the time taken by the referees to review our paper. I think Dr. Minix brings up an important point regarding collaboration between paramedics and physicians. Their clinical and academic backgrounds can be very complimentary. I am glad to hear that the Pinellas system will be

expanding the input and bibliographic referencing with future revisions. It may be difficult to get very many of the field paramedics to participate in the feedback loop without a forum that incorporates their direct involvement. Typically, medical control interacts with the supervisory and training staff personnel in such matters. The field paramedics need to participate more. Through regular and frequent continuing education activities such as morbidity and mortality conferences, case reviews, and journal clubs, there will be opportunities for field personnel and their medical directors to interact and critique the protocols in light of their experience and new information they extract from the literature.

Mr. Whitehead's suggestion to review protocols from other systems is a good one, particularly to get ideas on which disorders to cover by a protocol and the format by which to present them. However, unless the protocols from other systems have a bibliography, I would be hesitant to use them because the clinical rationale behind them is not always so obvious. Even the new Pinellas protocols leave much to be desired for references. I hope that the Pinellas County protocol committee will work on improving the references and perhaps use them as a part of a continuing education process, perhaps through a directed reading program. I don't want to see systems fall into the trap described by Dr. Toscano of developing new protocols on the basis of other protocols with a few minor alterations. A system must consider the least common denominator

factor in the clinical competency of its personnel, the rigor of its medical audit process, and the quality of its continuing education programs in determining the degree of autonomy and discretion allowed in the field. To do otherwise is not unlike taking someone else's prescription medications. It may not suit your system - it may even be toxic.

The remark by Dr. Toscano about the all too common feelings of intimidation in many paramedics by the expertise of physicians is true. That is another reason why I suggest more interaction between paramedics and physicians in academic activities such as journal clubs and case study conferences. Get field paramedics comfortable with their medical directors, being critical readers of research papers and questioning the clinical rationale behind their protocols. Medical directors would do themselves and their systems a great service by gearing continuing education programs more like residency programs than rote memorization exercises.

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Errors in Anti-Shock Trousers 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 spineboard 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 binder 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.

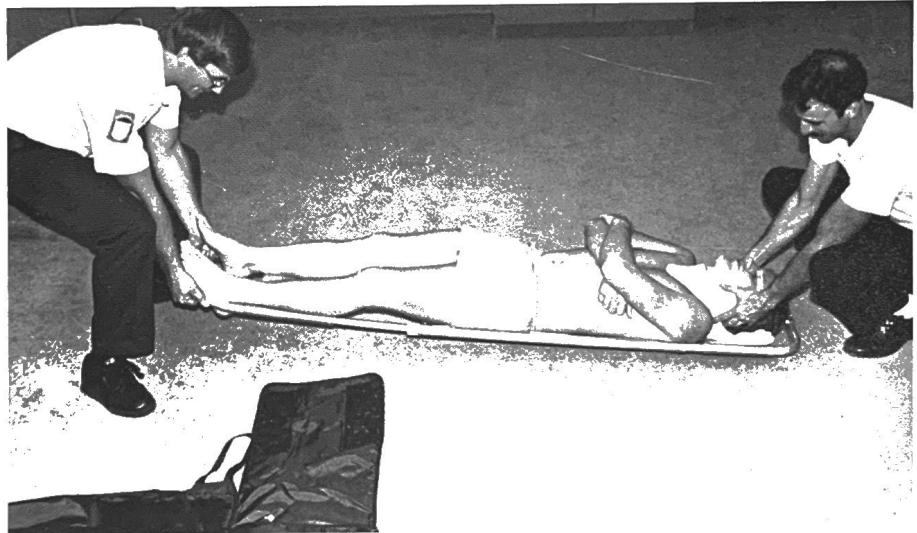
For the orthoscoop application, the patient is first

“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,

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.



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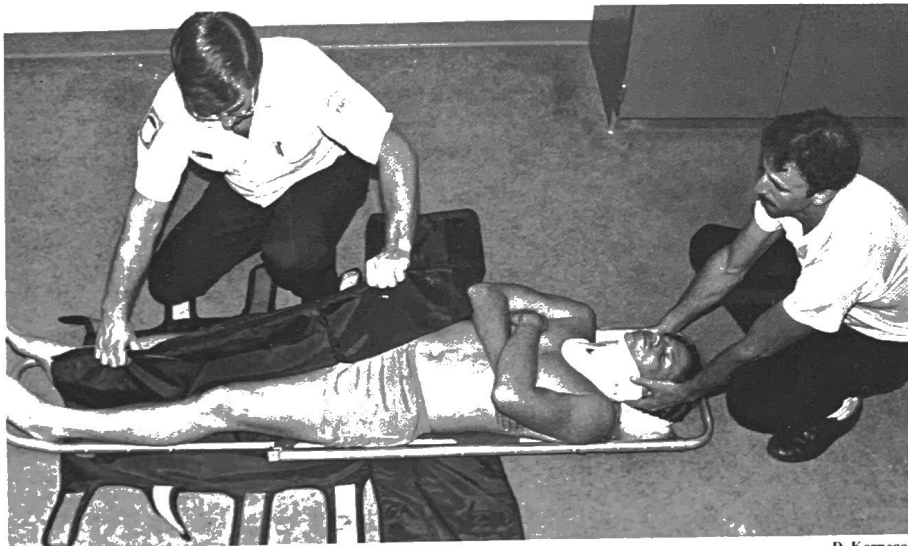


Figure 4 - Pull Front of Leg and Abdominal Sections Anteriorly - The bladder sections for both legs and the abdomen are pulled up between the patients' legs and the halves of the stretcher.

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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.

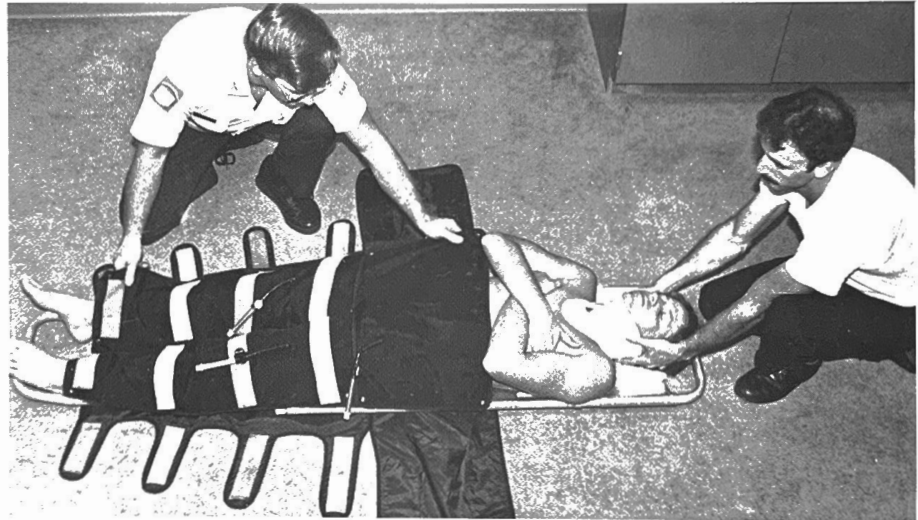
Orthoscoop application appears to avoid many of the the problems of multiple person coordination, log rolling, and garment positioning. However, the safety of the orthoscoop stretcher has been questioned for cases of suspected spinal

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

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.



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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.

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Heat Related Illness - Practical Considerations in Prehospital Treatment and Prevention on the Firegrounds

KIMBERLY W. PIERSON, RN, REMT-P

Heat related illnesses affect multitudes of people and can become life threatening emergencies if not rapidly identified and treated.

Persons who engage in strenuous physical activity especially when temperatures and humidity are increased are at greatest risk. Those involved in active training in the military (1,2,3) and athletes (4,5,6) are at acute risk for developing heat related illnesses.

The very young and very old (1,7) are highly susceptible to heat. The young because their surface area is larger in relation to their size and their lack of fat layers required for insulation (1,8). The elderly have difficulty compensating due to decreased circulation and other physiologic changes associated with aging.

Also at risk are individuals with diseases such as diabetes mellitus, cystic fibrosis, alcoholism, and those suffering from obesity or cardiopulmonary disorders (1,8).

Certain medications affect the body's ability to regulate heat production. Phenothiazines, diuretics, propranolol, amphetamines, anticholinergics, MAO inhibitors (2) and many others interfere with the ability to dissipate heat. Persons taking any of these drugs need to be well monitored.

At ultimate risk are firefighters, who not only engage in strenuous physical activity, but don heavy, insulated suits for entry onto burning buildings with temperatures often in excess of 1,200°F. For this group we will define the scope of the problem, attempt to establish criteria for unsafe operations, and discuss definitive therapy for restoration of acceptable functional ability.

PATHOPHYSIOLOGY

To maintain a constant core temperature, heat loss must equal heat production. Heat loss through radiation, conduction, evaporation, convection, exercise, and work must equal heat produced through metabolism (4,6,9). If heat production exceeds heat loss, the temperature will rise. When the temperature increases, the hypothalamus, the body's temperature control center, is stimulated to increase sweating and peripheral vasodilation so that the blood can bring excess

heat to the surface where it can be dissipated by convection, evaporation, or radiation (1,8,9). The cardiac output also increases, thereby increasing the rate of heat dissipation (10).

As long as the outside temperature remains lower than that of the skin and the humidity stays below 75%, the mechanisms remain functional (21). As temperatures and humidity increase, heat loss diminishes and heat may begin to be absorbed by the body. This excess heat can now only be diffused by evaporation (9,11). As the humidity increases, the rate of evaporation decreases, as the air is already saturated.

A normal individual loses approximately one liter of fluids per hour during exertion through sweating (4). Thermo-regulatory failure may halt sweat production, causing body temperature to increase, often above 106°F (6,8). During extreme heat, losses of two to three liters per hour may occur (8). If the cycle is not broken, electrolyte imbalances may result in significant hypokalemia and hyponatremia (7,12).

There are three basis disorders of heat regulation - heat cramps, heat exhaustion, and heat stroke.

Heat cramps are painful muscular spasms that involve muscle groups that have been strenuously exercised. Generally, there are no problems associated with mental processes or orientation. Heat cramps are thought to be caused by sodium depletion despite adequate water replacement (1,2,9). Murphy suggests that cramps are caused by a fluid volume problem which can be prevented by providing copious amounts of water (6).

Heat exhaustion is by far the most common heat-related illness. It occurs when the body loses excessive sodium and water due to profuse sweating (9,13). Symptoms of heat exhaustion include extreme thirst, headache, fatigue, dizziness, weakness and cool, pale skin with profuse sweating. In addition, altered levels of consciousness, irritability, postural hypotension, tachycardia, and mild elevations in body temperature have been reported (9).

Heat stroke is a life-threatening medical emergency. It occurs when physiologic mechanisms are unable to compensate for heat produced or the environmental temperature (2). Heat stroke can be categorized as non-exercise or exercise induced. Both are characterized by hyperthermia, with temperatures often greater than 106°F (6,8,9), altered levels of consciousness, hot dry skin, and tachycardia. Severe central nervous system disturbances such as seizures or coma

Instructor, Emergency Medical Technology Program, St. Petersburg Junior College; Contributing Editor, Tampa Bay EMS Journal; Largo, Florida

may present (9,12). Electrocardiographic changes may include ST depression, T wave inversion, conduction disturbances, and ventricular tachycardia (1,2). If temperatures persist above 106°F, brain damage may result (2,9,12).

PREVENTION

Prevention is the key to treating heat-related illnesses. Rest is necessary to promote normal recovery from exhaustion, as well as for general well being (3,14).

Food is important because it supplies the individual with the calories necessary to create energy for muscular effort. Proteins are important in the diet, however, they don't significantly contribute to quick energy requirements (15).

Fats in the diet should equal about 25% to 30% of the total daily caloric intake (15). This doesn't necessarily mean that the diet should be supplemented with additional fats because the content in a normal diet provides a sufficient amount. The total elimination of fats from the diet is not recommended. Muscles, including the heart, require certain fatty acids for energy (15). An absence of all fats in the diet can result in permanent disabilities or death (15,16).

Fats and proteins are important for maintaining overall health, but carbohydrates are the major source of energy. Carbohydrates should make up at least 55% of the daily caloric intake. The majority of these should be from complex carbohydrates (starches) rather than simple sugars (55). Complex carbohydrates take longer to digest and are therefore available for more sustained energy. They also help to provide necessary fiber, vitamins, and minerals.

Along with good nutrition, it is necessary to maintain proper salt and water balance. Dehydration is a serious problem for those involved in strenuous activities. Extreme exertion can cause the loss of several liters of water as sweat. To compensate, water is pulled from the plasma to control body heat (8). Unless this water is replaced, serious consequences may develop. To prevent dehydration, Dr. Richard Gerson, Director of St. Anthony's Hospital Wellness Center, claims that it is important to prehydrate, hydrate, and rehydrate. This is corroborated by a American College of Sports Medicine position statement on prevention of thermal injuries during distance running (17). Furthermore, trainers for the Tampa Bay Buccaneers maintain that "constant hydration is the way to go to combat heat-related illness." They have observed that the leaner the person, the faster they tend to cramp. Until recently, it was thought that excessive water intake could cause cramps. It is now advised that individuals drink cold water, perhaps in unlimited amounts (6). Cold water is palatable and is absorbed quickly from the stomach.

There is considerable controversy regarding the amount of electrolytes that are really lost in sweat. The consensus suggests that water is the most significantly depleted factor lost in sweat (1,7,12). Williams believes that adding sugars

and electrolytes to water just delays its emptying from the stomach (17). Water may be the rehydration fluid of choice. Electrolytes lost in sweat will be replaced with the next meal. Humans can survive over thirty days without electrolytes. Without water, survival may be limited to as little as seventy-two hours (13).

EMS and fire personnel work schedules that usually interfere with normal rest, sleep and eating patterns. It is recognized that operational requirements may not allow for control over the timing of rest periods. If this is a constant situation, compensation via other means such as food and fluid intake should be instituted (3).

It has been observed that after several days to weeks, persons may become acclimated to hot climates, increasing their capacity for strenuous activity. Careful attention has reduced the incidence of heat stroke in athletes (6,17) and military personnel (3).

Acclimatization increases the metabolic efficiency of the body resulting in improved aerobic efficiency and an increased cardiac output (2). Acclimatized individuals sweat more efficiently, losing less sodium per volume of sweat (9).

On the firegrounds, a paramedic should be assigned the role of safety officer, working closely with the incident commander. The responsibility of the safety officer includes continuous assessment of personnel for the subtle, early signs of heat illness. Some of the responsibility must also be placed on the individual. Personnel should be instructed in recognition of early warning symptoms that precede heat illness. Recognition of symptoms, cessation of activities, and proper treatment can prevent serious heat illness. Early warning symptoms include piloerection on the chest and/or upper arms, chilling, throbbing pressure in the head, unsteadiness, nausea, and dry skin (17).

It is further advised that working personnel have a standing blood pressure of at least 90 torr. The hyperthermia factor of heat illness reduces cardiac output. Young, healthy and physically fit persons can compensate for long periods of decreased cardiac output. The standard tilt test can be used as a guide to prevent further injury. Individuals unable to satisfy the standing blood pressure or tilt test screening tests should be rehydrated, monitored, and reassessed. Return to duty should not be granted until there is clinical improvement (3,14,17).

As a prophylactic measure, susceptible individuals should be identified. Persons with large muscle masses seem to be particularly susceptible to loss of body water. Baseline weights may be helpful, because a fluid loss of greater than 3% of total body weight can signal danger (6).

TREATMENT

Heat cramps are easily managed in the field. Treatment includes removing the individual to a cooler environment,

rest, and administration of water (6), saline (8, 9), or electrolyte solutions (1,14,17).

Persons suffering from heat exhaustion should be withdrawn from activities. They should rest in a cool environment. If possible, fan the individual to speed the cooling process. Provide oral or intravenous replacement of water and sodium (1,8) or electrolyte solutions (14,17).

Heat stroke is characterized by a body temperature of at least 105° F (40.6° C). Successful management depends on early recognition and aggressive therapy. Clinical findings often include hyponatremia, hypokalemia, metabolic acidosis, hypophosphatemia, hypocalcemia, and hypomagnesemia (7). All of these are common and potentially lethal (88). Treatment is aimed at immediate cooling by immersion in an ice bath, use of a hypothermia blanket, ice packs to the axillae and groin, or ice water lavage (1). Management in the field may include submersion in water, spraying with water from a hose, or applying ice packs to the axillae or groin (12). Severe cases of heat stroke require management in an intensive care setting.

During the heat stroke cooling process, the temperature must be carefully monitored. Treatment of metabolic acidosis with oxygenation and ventilation (2) may be preferable to sodium bicarbonate (1,12). Mannitol may be administered to decrease cerebral edema and promote urine flow through diuresis (1,12). Potassium may be given for hypokalemia (12). However, potassium should never be given prophylactically due to the risk of preexisting hyperkalemia (1). To prevent shivering when the victim is on a cooling blanket, chlorpromazine is often recommended (1,12). Intake, output, and central venous pressures should be monitored to evaluate the effectiveness of fluid replacement. The ECG must be monitored for arrhythmias induced by either the heating or cooling process. Complications of heat stroke include coagulation disorders, convulsions, cardiopulmonary difficulties, and disorders of multiple organ systems (12).

The military and organized athletics have already resolved many of the logistics regarding exertional heat illness and task performance. The fire service could derive great benefit from their prior research. Therefore, I suggest that some attention be given to determining standards to be followed on the firegrounds to promote individual safety in this unstable environment.

REFEREE COMMENTARY

Don Seiler (Exercise Physiologist, Director of Health Promotion, St. Joseph's Hospital) - The description of temperature balance in the body may cause some confusion. Certainly heat is lost through evaporation of sweat, but it can be gained or lost through radiation, conduction, and convection. Exercise is always on the side of the equation that increases body temperature. Firefighters must be aware that as their physical activity increases, their potential for injury increases.

Firefighters must also be aware that exercise induced heat stroke may occur before cessation of sweating. Marathon runners have been observed with body core temperatures in excess of 42°C in the presence of profuse sweating. Disorientation and piloerection are probably more reliable warning signs of serious problems.

Two important nutritional factors were overlooked when discussing prevention. These are the effects of alcohol and caffeine. Both drugs act as diuretics and promote dehydration. As Dr. Gerson Notes, prehydration is an important aspect of prevention. Alcohol consumption on the night before shift change can result in severe dehydration and an early firecall could be hazardous. The constant intake of caffeine containing beverages can result in the same problem. In terms of prevention, it is also important to recognize the effect that body composition has upon heat regulation. Firefighters with a high percentage of body fat are at special risk for heat injury and should be counseled on ways to reduce this risk. Fitness level is another important preventative factor. Thermoregulation is greatly improved in trained individuals. Especially if they train in similar environmental conditions.

Gordon W. Yaudes, REMT-P (District Commander and Paramedic, Clearwater Fire Department, Pinellas County EMS) - It is well documented that firefighting is the most physically demanding and dangerous profession in the United States. Danger exists not only from smoke, fire, collapse, chemicals, and electricity but also from fatigue and dehydration. Fireground commanders will agree the safety of the firefighters is of primary concern. This often involves the assignment of a Safety Officer. Because of the scope of the Safety Officer's responsibilities, many departments fill this position with a staff officer. The individual assigned must be familiar with all techniques of firefighting. A qualified individual which readily comes to mind is the Training Officer. The Safety Officer cannot limit his/her thinking to just fatigue, dehydration vs. relaxation, rehydration but must be concerned with entire fire scene safety. I feel the Safety Officer's job should be more "fire" oriented than "medically" oriented.

As the incident escalates, a rehabilitation area needs to be established under the Safety Officer. The area needs to be away from the actual firefighting activities. The area should be air conditioned or at very least shady. Liquids and paramedical support should be provided. Crews should be rotated to this area to receive rest, liquids, food if necessary, and medical evaluation. A convenient rotation time is the use of one breathing apparatus bottle. In order for the rotation to be feasible, the fireground commander must summon additional fire apparatus (alarms) as soon as possible. Once through rehabilitation, crews can be reassigned, held in reserve, released, or targeted for hospital exam.

The previous article stresses the importance of prevention. Firefighters must be educated to drink liquids in rehab even when not thirsty. They also should cool down and rest even though they badly want to be "back in the action."

The present shows many apparatus carry liquids/coolers/water so rehab areas can be set up with arrival of the first apparatus. Fireground Commanders are being trained in the Incident Command System including the importance of the Safety officer and the Rehabilitation Area. Firefighters attitudes are changing regarding safety and rehabilitation. Fire Departments are developing S.O.P.s regarding firefighter safety and incident management.

The future may bring air conditioned, crew cabbed apparatus

where crews can be rehabilitated in a climate controlled environment.

Ms. Pierson's Response - In researching the paper, I did not find specific mention of caffeine or alcohol, but Mr. Seiler's comments about their diuretic actions certainly make a lot of sense. Caffeine intake is a common morning activity at a firehouse. Mr. Seiler brings up a good point about sweating and heat exhaustion. Persons coming out of bunker gear will be wet regardless of anhidrosis, due to retained perspiration in the fabric liner. This can give a false sense of security about the absence of heat stroke. Re-education may be appropriate for fire and EMS personnel to look for disorientation and piloerection as early clinical signs of heat stroke. It is important for individual firefighters to watch for these signs in themselves and their colleagues. To ignore them invites disaster.

The organizational structure used to perform medical screenings for heat illness isn't important, so long as all the bases are covered. The potential problem must be identified and someone must be assigned to address it, whether it's a safety or a rehabilitation officer.

I would like to hear from the fire departments and EMS agencies about the validity of these ideas in daily practice. All this may be fine in theory, but does it really have an impact on the incidence of heat related illness? There is already so much we learn in the classroom that has no practical application in the field. Both reviewers make excellent points worthy of further consideration. Let's make this something we can really benefit from rather than letting it die on the vine. I would like to thank Mr. Seiler and Mr. Yaudes for their input.

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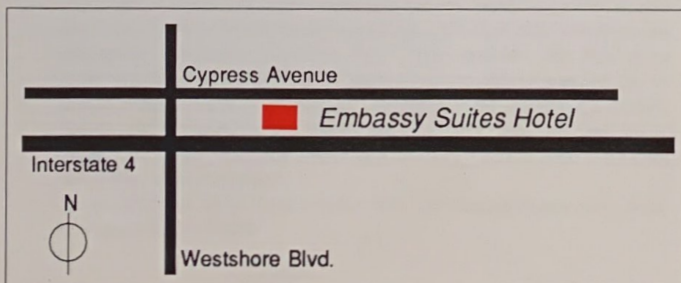
ACUTE CONGESTIVE HEART FAILURE

October 21, 1987

8:00 A.M. to 1:00 P.M.

Embassy Suites Hotel - Tampa Airport

The Protocol Roundtables are an on-going series of symposia, each of which explore a single emergency problem with a distinguished panel of emergency and critical care specialists, paramedics and nurses. They will review the pathophysiology, identify therapeutic objectives, present the latest research literature and review current local protocols. This information will then be used in a roundtable discussion with the panel and audience to develop a model protocol and bibliography that may be used by EMS agencies and hospitals as a resource for their own protocol development efforts. We invite you to take part with your colleagues in this extraordinary academic forum. The session will finish at 1 P.M., so come early and join us for breakfast, on us and the beautiful Embassy Suites Hotel. We ask that you register early, as space is limited to provide a better opportunity for you to participate in the discussions.



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October 21, 1987
Embassy Suites Hotel
Tampa, FL

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Book Review

Streetsense

By Kate Dernocouer, REMT-P

As I began reading this book, my approach was similar to that for a standard textbook. The "task" soon turned to compulsive reading, mixed with many fond (and not so fond) recollections of my twelve-plus years as a street paramedic, supervisor and educator.

Streetsense contains three sections. Section I deals with communication - with patients, co-workers, and special populations such as the elderly. The author, Kate Dernocouer, shows a refreshing sensitivity to the need for improved communications among EMS workers. Section II is about safety, mainly in the form of do's and don'ts, peppered with tricks of the trade. The material in these two sections has been partially covered by other EMS texts. Thus, I found some parts dry, others informative. Section III, however, covers a relatively untouched area, that of control. It begins with a well written overview of stresses found in EMS. The legal risk chapter would have fit into Section II more comfortably, but

was good. Dernocouer saved the best for last. Chapters 14 and 15, one on scene control and the other on choreography, respectively. These chapters are some of the most useful I've seen written in several years. They deal with skills that are more art than science. The author has put into print concepts that are rather nebulous and not thoroughly researched in any other EMS book to my knowledge.

Streetsense is more than a textbook. It is your senior partner, giving a philosophical guiding lecture on the joys and pitfalls of prehospital care. I recommend this book as required reading for any EMS student - novice or veteran.

Kate Dernocouer: *Streetsense*. Brady Communications Co., Bowie, MD, 1985. Approx. 228 pages, \$16.95.

Reviewer: Joe A. Nelson, D.O.
Emergency Department, Carrollwood
Community Hospital

Abstracts

Compiled By: Journal Staff

Base Station Prehospital Care: Judgement Errors and Deviations From Protocol

WASSERBERGER J, ORDOG GJ, DONOGHUE G, BALASUBRAMANIAM S

Annals of Emergency Medicine 16:867-871, 1987

5,994 paramedic calls during a three year period were studied for the incidence of base station operator deviation from established prehospital care algorithms and standard medical practices. Base station operators were emergency medicine residents and mobile intensive care nurses. Information for each call was obtained from written paramedic reports, audio tapes from the base station radio and written reports from the base station operators. 336 deviations were identified in 283 patients by the base station liaison physician. All deviations were reviewed by a panel of board certified emergency physicians. Deviations consistent with standard care (43%) were not considered errors. There were 193 deviations (57%) from standards of medical care. The most common deviations were in failure to administer prophylactic lidocaine to stable adult patients with non-pleuritic chest pain (19.2%) and failure to apply cervical immobilization to suspected head trauma cases (9.2%). Half of all deviations without sound medical judgement were made by base station operators not having adequate knowledge of the prehospital algorithms. The authors conclude that physicians in charge of medical control should be aware that algorithm deviations by base station operators are frequently in conflict with standard medical care and often reflects a need for reinstruction on prehospital care protocols. Request reprints from: Gary J. Ordog, MD, Emergency Department, King/Drew Medical Center, Box 219-12021 S, Wilmington Ave., Los Angeles, CA 90059

Prehospital Advanced Life Support vs "Scoop and Run" in Trauma Management

GOLD CR

Annals of Emergency Medicine 16:797-801, 1987

The advantages and disadvantages between ALS and BLS level care for prehospital trauma care are reviewed. The author asks if ALS in the field has proven benefit or if it simply a costly exercise in futility. The discussion minimizes the potential benefits of field ALS for patients that are not critically compromised as well as those with injuries so severe that there is no hope for survival. The subpopulation between these two extremes are likely to have outcomes significantly affected by field care. However, the ability to reliably identify this subpopulation is questionable, despite the use of any currently available trauma scoring method. The need and efficacy for airway control with endotracheal and esophageal obturator devices are discussed and the lack of data correlating either device to mortality is identified. Similar debate is presented regarding MAST and IV crystalloid replacement in the field. The research into the overall impact of ALS vs BLS level care is discussed, with conflicting results. Medical control is also discussed in terms of field autonomy as opposed to tight radio control by the emergency department physician. The author concludes that there is no clear cut answer to the field stabilization vs scoop and run approaches. An appeal is made for well controlled, prospective and randomized studies, despite the controversy of ethics regarding prehospital randomization. Support for a complex EMS system appears to be based on hope of efficacy rather than objective proof.

Request reprints from: Claudia Gold, MD, 187 Oranglethorpe Ave., Suite H, Placentia, CA 92670

Paramedic Perception of Elapsed Field Time

JURKOVICH GJ, CAMPBELL D, PADRTA J, LUTERMAN A

Journal of Trauma 27:892-897, 1987

The authors attempted to accurately quantify how much time various procedures actually take in prehospital ALS care and to determine if paramedics accurately perceive how much time various procedures and phases of care really take. This latter point is suspect as a possible explanation for extended trauma scene times. Ten experienced paramedic teams were scored by an independent observer. The observer recorded the entire EMS call on audio tape recorder with verbal notation when each procedure was started and completed. After each call, the paramedics were asked for their estimate of response, on-scene, and transport times. The estimates, with allowance of a two minute margin of error, were compared to stopwatch measures made from the tape. Intubations actually took 2.3 min (SEM=0.69) with a mean perceived error of 28%. The first IV took 5.0 min (SEM=0.47) with 27% perceived error. Anti-shock suit application took 2.25 min (SEM=0.25) and a perceived error of 11%. With shorter field times, actual run times tended to be overestimated while long scene times tended towards underestimation. The authors conclude that paramedic misperception of scene and procedure times should prompt medical control to monitor elapsed time to alert paramedics when further delay could jeopardize patient outcome.

Request reprints from: Gregory J. Jurkovich, MD, Department of Surgery, University of South Alabama, 2451 Fillingim St., Mobile, AL 36617

A New Method of Rapid Fluid Resuscitation During Thoracotomy Performed in the Emergency Room

SAMELSON SL, ROBIN AP, MERLOTTI GJ, ET AL

Surgery, Gynecology & Obstetrics 165:175-176, 1987

A new technique for infusing massive quantities of fluid during open chest resuscitation is described from the experience of the Trauma Unit of the Cook County Hospital. Their open chest technique usually includes left anteriolateral thoracotomy and direct control of the injury or aortic cross-clamping. A foley catheter is then inserted into the right atrial appendage through a small stab wound. Tissue is cinched around the Foley by purse string suture. This purse string suture has been prone to atrial tears, leaking, slippage of the catheter and time delays. Their new technique replaces the purse string suture with a standard umbilical cord clamp, with a hole drilled through the jaws to fit around the diameter of the Foley catheter. The wound is quickly sealed without catheter movement, leaks or interference with other procedures. A gentle twist of the clamp with a hemostat releases the clamp for removal of the catheter and repair of the atriotomy following successful resuscitation.

Facilitated Intravenous Access Through Local Application of Nitroglycerin Ointment

ROBERGE R, KELLY M, EVENS, TC, et al

Annals of Emergency Medicine 16:546-549, 1987

Peripheral venous access is often difficult in an emergency setting due to small veins, particularly with elderly and obese patients. A blinded and randomized study was conducted to determine if topical application of nitroglycerin ointment would improve IV access in emergency department patients with small veins on the dorsum of the hand. All IV attempts were

performed by ED physicians and nurses. The baseline diameter of the vein to be cannulated was measured before and two minutes after application of a quarter inch of ointment which contained either bland or nitroglycerin ointment. In the 34 patients of the study, 16 received bland ointment. 50% (8) of the bland ointment cases required more than one IV attempt. Of the 18 patients who received the nitroglycerin ointment, only 17% (3) required a second attempt ($P=.04$). Bland ointment cases had increases of vein diameter of no more than twice their original size while nitroglycerin cases increased by two to six times original diameter. No adverse effects were observed in any cases who received nitroglycerin ointment. This study demonstrates that locally applied 2% nitroglycerin ointment on the dorsum of the hand significantly improves the success rate for IV cannulation, without adverse effects.

Request reprints from: Raymond Roberge, MD, Division of Emergency Medicine, University Hospital of Jacksonville, 655 W. 8th St., Jacksonville, FL 32209

Are Rotating Tourniquets Useful for Left Ventricular Preload Reduction in Patients with Acute Myocardial Infarction and Heart Failure?

ROTH A, HOCHENBURG M, KEREN G, ET AL
Annals of Emergency Medicine 16:764-767, 1987

A study was conducted in 12 patients, 12 to 24 hours after admission, with their first MI and congestive heart failure as suggested by new onset of dyspnea and a PAWP >15 mm Hg. All subjects were clinically stable for at least 12 hours prior to research data acquisition. Using blood pressure cuffs as rotating tourniquets, subjects were hemodynamically monitored from baseline to cuff pressures of 30 mm Hg for 15 minutes, then 15 minutes without cuff pressure to return to baseline, and finally to cuff pressures of 60 mm Hg for 15 minutes. There were no statistically significant changes in hemodynamics or blood gases during the experiments. None of the patients reported any subjective improvement in dyspnea. The authors conclude that rotating tourniquets are an outmoded procedure and should no longer be utilized in the treatment of congestive heart failure secondary to myocardial infarction.

Request reprints from: Shlomo Laniado, MD, Chief, Division of Cardiology, Ichlov Hospital, 6 Weitzman St., Tel Aviv, Israel

Multiple Dose Activated Charcoal for Theophylline Poisoning in Young Infants

SHANNON M, AMITAI Y, LOVEJOY FH
Pediatrics 80:368-370, 1987

Repetitive nasogastric administration of activated charcoal has demonstrated efficacy with increased clearance and reduced half-life of ingested and intravenous agents, by a GI dialysis in which toxins are drawn into the gut, bound with charcoal and removed with the stool. However, there was little experience with this technique in small children. The authors present 5 cases of theophylline and aminophylline overdose in infants between 2 weeks and 5 months of age. All overdoses were due to errors in medication calculation or administration of a ten fold magnitude. Age and weight of the patients were not found to be limitations for safe and effective use of the technique. This method appears to be an alternative to hemodialysis and hemoperfusion. While the study was conducted with theophylline toxicity, the method should be useful for overdose on other agents such as phenobarbital and aspirin.

Request reprints from: Michael Shannon, MD, Massachusetts Poison Control System, 300 Longwood Ave., Boston, MA 02115

Plasma Atropine Concentrations Via Intravenous, Endotracheal, and Intraosseous Administration

PRETE MR, HANNAN CJ, BURKLE FM

American Journal of Emergency Medicine 5:101-104, 1987

The time to reach and actual level of peak plasma atropine concentrations were measured following intravenous (IV), endotracheal (ET) and intraosseous (IO) administration in a group of six macaques. Time to peak concentration was shortest with the IV route (1.37 min, SE=0.26), followed by IO (3.87 min, SE=0.86) and ET (9.62 min, SE=2.60) routes. Mean plasma concentrations were significantly higher for the IV route at 1.25 min after administration, but IO levels exceeded IV and ET levels at 5, 15 and 30 minutes. The authors conclude the IV route has the shortest time to reach peak plasma atropine concentration, but total concentration levels were later exceeded by the IO route. Additional dose-response studies are needed to determine optimal therapeutic dosage for the ET and IO routes.

Request reprints from: Mark Prete, MD, Department of Emergency Medicine, Madigan Army Medical Center, Tacoma, WA 98431

Correspondence

The Correspondence section is designed to accommodate feedback and debate regarding papers previously published in the Journal. It is also an appropriate place for other smaller items of interest that may not require the space of a separate article. The Correspondence section can be one of the most interesting parts of a professional publication, where published debate can fully explore all sides of an issue. We invite critique and comment. Direct all correspondence to be considered for publication to the Correspondence Editor, Tampa Bay EMS Journal, P.O. Box 280173 Tampa, Florida 33682.

Calendar

The Journal wishes to promote continuing education and other academic events open to the EMS and critical care community by offering free listings of such events in this section. Please submit the name of the event, sponsoring organization, date, time registration information, tuition and a contact person address and phone number for additional information.. Calendar items must be received no later than 45 days prior to our quarterly publication dates on the first of January, April, July and October to appear in the next issue. Send items to the Calendar Editor, Tampa Bay EMS Journal, P.O. Box 280173, Tampa, Florida 33682 or call 813/988-0115.

October 21, 1987

Protocol Roundtable: Acute Congestive

Heart Failure

Embassy Suites Hotel, 4400 W. Cypress Ave., Tampa, FL. Tuition \$30 for ACF members, \$40 non-members. For additional information, contact the Acute Care Foundation, P.O. Box 280173, Tampa, FL 33682, 813 / 988-0115.

May 6-7, 1988

Symposia on Prehospital Medical Control and Continuing Education

Embassy Suites Hotel, 4400 W. Cypress Ave., Tampa, FL. Call for abstracts. For additional information, contact the Acute Care Foundation, P.O. Box 280173, Tampa, FL 33682, 813 /988-0115

Guidelines For Authors

Please submit all materials to be considered for publication to:

Michael R. Gunderson, REMT-P
Editor, *Tampa Bay EMS Journal*
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ACADEMIC PURPOSE AND REVIEW

The *Tampa Bay EMS Journal* is an academic publication serving the emergency medical community. It is published by the Acute Care Foundation, a non-profit organization dedicated to the academic development of EMS.

Manuscripts submitted to the *Journal* should concern the prehospital or in-hospital care of emergencies or related technical, logistical, educational or administrative issues. Acceptance for publication will be based on significance, validity and originality. These assessments will be made by the editorial staff and advisory board. After acceptance for publication, selected manuscripts will be subjected to additional referee review by persons who may or may not be members of the editorial advisory board. These referees will be asked to submit commentary that will appear immediately following the article. The author(s) will be given an opportunity to respond in print to referee comments and provide closing remarks. The article, referee commentary and author(s) response will all appear together as a single paper.

A major goal of the *Journal* is to stimulate academic activity in EMS. Persons who have not previously submitted work for publication in a medical journal are strongly encouraged to do so. The *Journal* staff will attempt to provide any assistance it can to new authors (see "Assistance in Preparation of Manuscripts").

COVER LETTER

All manuscripts should be accompanied by a cover letter. The cover letter should specify if this or a similar manuscript has been published, accepted or is under consideration by another publication. The cover letter should make mention of any facilities that are available to the authors for transmitting the article to the *Journal* via modem or on a personal computer diskette (5 1/4" MS-DOS or 3 1/2" Macintosh). Availability of an electronic version of the article may expedite the review and publication process. The cover letter should also address issues of institutional review board involvement, human or animal, if the article presents original research. Authors of articles accepted for publication will be asked to transfer copyright to the Acute Care Foundation, Inc.

MANUSCRIPT FORMAT

The manuscript should be submitted in triplicate (one original and two copies). Use plain white paper, 8.5 by 11 inches, with 1 inch margins on all sides. Lines should be double spaced, excluding the bibliography. The bibliography should be in the form used by Index Medicus. The names of journals not listed in the Index Medicus should not be abbreviated. Use the following as examples:

Journal citation - Harrison EE, Arney BD: Use of Calcium in Prehospital Cardiac Arrest. *Ann Emerg Med* 1984;13:820

Chapter citation - Yendt ER: Disorders of Calcium, Phosphorous and Magnesium Metabolism. in Maxwell MH, Kleeman CR(eds): *Clinical Disorders of Fluid and Electrolyte Metabolism*, ed 2. New York, McGraw-Hill, pp 401-504

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Editorial

Professional or Vocational Career Development

Modern prehospital EMS has evolved from a not so distant legacy of ambulance attendants and first aid squads. While training requirements and logistics have become more sophisticated, the work environment remains largely vocational rather than professional. In this context, the difference is largely in the perception of field personnel.

In a vocational environment, field personnel are perceived as technicians, taught to do specific tasks under specific circumstances. They are not responsible for insight on the rationale or problem solving approaches behind their actions. Their training and accountability becomes limited to identification of a circumstance and execution of a corresponding set of procedures. There is no expectation for continued academic advancement, contribution to the discipline through research, peer review, or participatory management.

A professional environment has field clinicians. Their education is based on an understanding of the pathogenesis for common patterns of critical disease and injury. This is used as a template for evaluation and treatment of real patients on a case by case basis, often involving more than one problem. Initial certification is the minimum requirement to enter the profession. The responsibility for continued academic growth and contribution to the state of the art rests with the individual, not their EMS agency. However, their support staff in administration builds programs into the system and workplace that facilitates and encourages these professional behaviors. Through participatory management practices, each field professional has an opportunity to develop a niche where they can take an issue into their charge and work to resolve it. They develop personal accountability.

There are many very talented individuals in the substations. Shifting the trend away from vocationalism towards professionalism will take leadership. EMS administrators should try to develop participatory management, continuing education, support for research, and peer review programs. The field clinicians should take the primary initiative, regardless of management support, to build their careers from a professional perspective. Position along the vocational - professional spectrum is a significant discriminator between the mediocre and superior systems and paramedics. A superior system and its paramedics must have the capacity for clinical and academic excellence. That is what the Acute Care Foundation is all about.

Proposed Changes in 10D-66

The State of Florida EMS Office is considering several changes to Chapter 10D-66, the rules which regulate EMS throughout the State. In the draft, dated 7/30/87, are items regarding the procedures and drugs that will be authorized for paramedic use in the State of Florida. In current rules, 10D-66.057 gives examples of the types of procedures and drugs that are allowed, in addition to "Other drugs deemed necessary by the Advanced Life Support Medical Director, subject to the provision of these rules." This current language does not restrict what procedures or drugs can be used, so long as the ALS medical director authorizes it and they are not in conflict with other parts of 10D-66.

In the proposed version of 10D-66.057, the language will be changed in such a way that places all responsibility for authorized drugs and procedures with the DOT Paramedic Curriculum. The medical director will apparently lose the ability to authorize any procedures or drugs that are not in the DOT curriculum. This language would seem to prohibit EMS agencies in the State of Florida from participating in any innovation or research efforts that include items outside the scope of the DOT curriculum.

Standards can be useful in bringing the lower end of the spectrum up to a higher level. The net effect of standardization becomes detrimental when it restricts efforts to reach higher.

Michael R. Gunderson, REMT-P
Editor

ACUTE CARE FOUNDATION

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The Acute Care Foundation is a non-profit charitable organization that has been chartered to provide academic resources to the prehospital, emergency department and critical care community.

Professional membership in the Acute Care Foundation provides an opportunity to participate in education and research programs on an interagency and interhospital basis. These programs are developed and conducted by Acute Care Foundation members operating through its committees in Community Education, Emergency Medical Television®, Professional Publications, Seminars and Symposia, Professional Certifications, and Post-Graduate Paramedic Education. These programs will be a prototype for implementation of similar efforts.

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Professional membership is limited to licensed health care professionals. Dues are only \$30 annually. Consider the benefits that the Foundation's interagency and interhospital collaboration in regional training and research programs can offer. This is an opportunity for you to interact with your colleagues on an interagency basis, enhance your professional experiences and credentials, and make a meaningful contribution to your EMS system. Please complete the Professional Membership application and help make a difference. Consider it an investment in our EMS community.

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The Acute Care Foundation is a non-profit, charitable and tax exempt organization that has been chartered to provide a means to promote academic activities in emergency medical service (EMS) systems. These programs are also designed to promote collaboration between the prehospital, emergency department and critical care sectors in joint research and academic programs to the benefit the EMS system as a whole. There are extraordinary human and material resources available between the various agencies and institutions that compose EMS systems within a region. The Acute Care Foundation was formed by EMS professionals to use these regional resources collectively for professional education, research and planning towards superior system design and exemplary quality in patient care.

The goals of the Acute Care Foundation are complementary to those of public and private organizations and businesses involved in providing or supporting emergency health care - the Acute Care Foundation needs their participation and financial support.

Corporate membership in the Foundation is available to corporations and other types of businesses having an interest in promoting quality within the emergency medical services industry. Corporate membership offers businesses and excellent opportunity to put something back into their communities and improve relationships with the clinicians, agencies, institutions and patients that Foundation programs ultimately benefit. Corporate membership also facilitates direct participation through appointment of a designated representative in Foundation committees.

The generosity and commitment to excellence of corporate members in the Foundation will be prominently and formally recognized in various ways, to include a full page acknowledgement in each issue of the new Tampa Bay EMS Journal that presents a dignified listing of all current corporate and organizational members.

Corporate membership is offered in levels corresponding to the size of an annual contribution pledge. The prestigious Primary Corporate Membership is available for an annual contribution of \$5000 or more. Major Corporate Membership is available for annual contribution pledges of \$2500 or more and Participating Corporate Membership is extended for annual pledges of \$1000 or more.

Overall, the advantages of corporate membership in the Acute Care Foundation should consider the a firm's professional relations program, marketing efforts and the tax advantages in charitable contributions. The Acute Care Foundation is an organization worthy of your firm's participation and financial support. It is an effective and influential group that your firm will be proud to be associated with. Consider your contribution to be an investment in our EMS community. Please contact the Foundation for any further information or to arrange for an appointment to your convenience.



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