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USE OF THE PNEUMATIC ANTI-SHOCK GARMENT (PASG)

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The National Association of EMS Physicians (NAEMSP) recognizes that medical direction requires, among other things, informed decision making regarding the out-of-hospital use of the pneumatic anti-shock garment (PASG). Therefore, guidelines for the education and experience of out-of-hospital providers in using the PASG are essential to safe and cost-effective patient care. In this spirit, NAEMSP offers the following guidelines for the medically directed out-of-hospital use of the PASG.

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SYNOPSIS

Since first used in emergency care during the 1960s, the PASG (or military anti-shock trouser—MAST), has become one of the most widely studied and intensely debated devices in EMS. The PASG has alternately enjoyed widespread support followed by harsh criticism. Even today, few devices engender such

divergence of opinion. The purpose of this paper is to put forth a framework to rationally analyze this issue, and to formulate recommendations based on the available data. With this goal in mind, the Standards and Clinical Practice Committee of the National Association of EMS Physicians developed this position paper and the accompanying review¹ of PASG uses in clinical

TABLE 1. Criteria Used to Evaluate Articles about Therapy

Validity of results

- Were patients randomized?
- Was attrition accounted for?
- Did patients remain in their assigned groups?
- Were participants blinded?
- Were groups similar at the start and treated equally?

Treatment effect

- Magnitude of effect
- Precision of measurement

Applicability

- Were all outcomes considered?
 - Are the benefits worth the cost and potential harm?
-

TABLE 2. Criteria Used to Evaluate Articles about Harm

Validity

- Were comparison groups similar?
- Were outcomes and exposures similarly measured?
- Was there a temporal relationship?
- Was there a dose-response gradient?

Strength of association

Precision of measurement

Applicability

- Magnitude of risk
 - Effect of intervention to stop the exposure
-

settings. Every effort has been made to objectively weigh available data pertaining to the use of the PASG in a wide variety of clinical situations, and to make specific, evidence-based recommendations.

What has emerged from our review is that while much is known about the physiologic effects of the PASG, there are numerous areas devoid of information. Using explicit criteria, approximately 375 clinical reports addressing the variety of proposed applications of the PASG were evaluated, resulting in recommended clinical applications for its use. Potential clinical applications of the device were based on the body of medical literature, whether reported as scientific studies, case reports, or correspondence. Where a particular application has not been well studied, or where evidence is anecdotal, recommendations are made given the best available information. It is the goal of this position paper to develop consensus regarding situations where the PASG is useful, where it is detrimental, and where its effect is unknown.

EVALUATION CRITERIA

Recommendations were predominantly based on two types of reports—articles about therapy and articles about harm. The criteria used to evaluate these papers were adapted from *The User's Guide to the Medical Literature series*^{2,3} (Tables 1 and 2). Whenever conflicting evidence was encountered, the relative merits of the disparate reports were weighted according to these criteria. If none of the papers pertaining to a specific clinical application met these criteria, conclusive recommendations were not made. For example, a conclusive recommendation cannot be made regarding the use of the PASG in anaphylactic shock, since the only pertinent papers are case reports, which do not meet the criteria. Anaphylactic

TABLE 3. Summary Recommendations

Class I	(Usually indicated, useful, and effective) • Hypotension due to ruptured AAA
Class IIa	(Acceptable, uncertain efficacy, weight of evidence favors usefulness and efficacy) • Hypotension due to suspected pelvic fracture • Anaphylactic shock (unresponsive to standard therapy)* • Otherwise uncontrollable lower extremity hemorrhage* • Severe traumatic hypotension (palpable pulse, blood pressure not obtainable)*
Class IIb	(Acceptable, uncertain efficacy, may be helpful, probably not harmful) • Elderly • History of congestive heart failure • Penetrating abdominal injury • Paroxysmal supraventricular tachycardia (PSVT) • Gynecologic hemorrhage (otherwise uncontrolled)* • Hypothermia-induced hypotension* • Lower-extremity hemorrhage (otherwise uncontrolled)* • Pelvic fracture without hypotension* • Ruptured ectopic pregnancy* • Septic shock* • Spinal shock* • Urologic hemorrhage (otherwise uncontrolled)* • Assist intravenous cannulation*
Class III	(Inappropriate option, not indicated, may be harmful) • Adjunct to CPR • Diaphragmatic rupture • Penetrating thoracic injury • Pulmonary edema • To splint fractures of the lower extremities • Extremity trauma • Abdominal evisceration • Acute myocardial infarction • Cardiac tamponade • Cardiogenic shock • Gravid uterus

*Data from controlled trials not available. Recommendation based on other evidence.

shock is thus classified as IIa in the setting of failure to respond to conventional therapy, with the qualification that, while the evidence favors its use in this setting, the evidence is not strong.

Once papers meeting these criteria were selected, they were reviewed and classified according to a system similar to the one used by the American Heart Association's Emergency Cardiac Care Committee.⁴ Study design, methods, source of the study, ethics of the study, and feasibility of application were evaluated to assign each PASG indication to one of the four classes (Table

3). PASG use was rated for the particular clinical circumstance. When data available from controlled clinical trials were insufficient, the recommended classification was listed with an asterisk (e.g., "Class IIb*"). These clinical situations are areas lacking controlled studies, and the recommendations are based on case series or other descriptive studies. In addition, when a clinical application is rated Class I or Class III, there is overwhelming evidence to support such a rating.

We developed a comprehensive list of clinical applications of the PASG, some of which are not com-

monly considered. The accompanying review details the rationales for these recommendations. The evidence used to make these recommendations was summarized during the PASG Policy Forum at the NAEMSP 1995 summer meeting in San Diego, California.

USE OF THIS POSITION PAPER

The goal of this position paper is to:

- Serve as a resource for physicians involved in EMS medical direction
- Identify areas where additional research is needed
- Incorporate this information into the NHTSA-DOT curriculum
- Describe the potential advantage of using the PASG at the discretion of medical direction for Class I and IIa indications
- Describe the acceptability of using the PASG at the discretion of medical direction for Class IIb indications, while acknowledging that evidence is not strong
- Describe the inappropriateness of using the PASG for Class III indications

Under no circumstance should this position paper be interpreted to be a standard of care. For example, to forego using the PASG for a Class I (Usually indicated, useful, and effective) or Class IIa (Acceptable, uncertain efficacy, weight of evidence favors usefulness and efficacy) indication does not imply substandard care. Our recommendation for these two classes is that the PASG should at least be considered, recognizing that other factors, such as the need for rapid transport, may supervene. For Class IIb (Acceptable, uncertain efficacy, may be helpful, probably not harmful) indications, the decision of whether or not to use the device should be based on a risk-benefit analysis by medical direction,

while accounting for regional factors. For Class III (Inappropriate option, not indicated, may be harmful), the PASG should not be used unless there are mitigating circumstances.

Thus, these classifications are intended to be used as guidelines to assist EMS medical direction in patient care, as well as in identifying priorities in provider training and certification. This information should be incorporated into all ranges of EMT curricula, from basic through intermediate to paramedic levels of training. While there is an extensive body of knowledge relating to the PASG, considerable gaps exist, offering an opportunity for additional investigation into this complex issue.

The secondary goal is to offer guidance to physicians responsible for all phases of medical direction in EMS. Whether or not to use the PASG in out-of-hospital care has been a vexing question. This position paper isolates clinical situations where there is evidence that the PASG is, or may be, beneficial, and describes other situations where its use may be harmful. In this way, physicians responsible for system-wide protocol development, and on-line medical direction, may refer to this policy.

The third, and perhaps more important, goal of this position paper is to identify areas where clinical evidence of efficacy is incomplete. While many of the physiologic effects of the PASG have been examined, much of the clinical evidence must be surmised from case reports, or uncontrolled clinical trials. Uses in the setting of paroxysmal supraventricular tachycardia or anaphylaxis and for local control of hemorrhage have been studied solely in case reports. In addition, some of the randomized trials examining other clinical indications have been difficult to control, owing to the myriad causes of the particular shock states studied. One area that warrants future

study concerns efficacy in severe hemorrhagic shock where the systolic blood pressure is less than 50 mm Hg. At least two previous studies have shown a trend towards improved survival with the use of the PASG.^{5,6} In one of these two studies, there was a statistically significant improvement in observed survival, compared with the expected probability of survival, when the PASG was used. If one could demonstrate effectiveness in the subpopulation of patients with hemorrhagic shock and systolic blood pressures of less than 50 mm Hg, this would clearly be an indication for use given the otherwise grave prognosis of these patients.

CONCLUSION

This position paper has described the relative clinical efficacies of the PASG under a variety of clinical settings, based on information that is currently available. This information is intended to guide decision making in medical direction of EMS. The recommendation is that for Class I and Class IIa indications, EMS providers be taught that the PASG is an acceptable treatment modality, but that medical direction may or may not elect to use it for these indications based on local factors. For Class IIb indications, there is less compelling evidence regarding efficacy. However, EMS providers should still be taught that the PASG is an acceptable treatment modality, and that medical direction may or may not elect to use it. For Class III uses, the PASG is contraindicated.

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