Pneumatic anti-shock garment—does it have a future?

M.J. CLANCY

Department of Accident and Emergency Medicine, Bristol Royal Infirmary, Bristol, UK

SUMMARY

A total of 100 accident and emergency (A&E) departments in the UK responded to a questionnaire about their use of the pneumatic anti-shock garment (PASG). Less than one in 10 departments used PASG in their prehospital care system, less than one in five departments used PASG during in-patient care, and there was wide variation in PASG usage in those situations for which their use is recommended by the Advanced Trauma Life Support (ATLS) course.

Key words: Accident and Emergency departments, Pneumatic anti-shock garment, UK

INTRODUCTION

The use of pneumatic compression to treat hypovolaemia was first reported by Crile in 1903.¹ Interest waned with the advent of intravenous techniques, but was reawakened in 1971 by Cutler and Dagget's report² of the use of PASG during the Vietnam war, and civilian use rapidly followed.³

The modern garment consists of a one-piece device made of polyvinyl fabrics, which encloses the body from the lower rib cage down to but not including the feet. Three separate compartments cover the abdomen and legs, and each can be independently inflated and deflated. Pressures are typically limited to 100 mmHg by the ability of the velcro fasteners to withstand stress. Four mechanisms of action have been proposed,⁴ namely tamponade of bleeding vessels beneath the suit, increase in peripheral resistance of the lower body, selective perfusion of the upper body, and an increase in venous return from the lower body.

The 1988 ATLS manual advocated the in-hospital use of PASG for those patients who are in shock after abdominal trauma and after sustaining pelvic fractures. Norton and Frumkin state, in the latest edition of *Clinical Procedures in Emergency*

Medicine (1992)⁶ that 'PASG is widely used both by emergency room technicians and paramedics in the prehospital care of hypotensive patients and by hospital emergency departments, and Critical Care Personnel'. PASG has also been advocated in the management of such non-traumatic conditions as leaking abdominal aortic aneurysms⁷ and pelvic bleeding having gynaecological causes.⁸

The only completed prospective study of the use of PASG in the management of trauma, by Mattox *et al.*,⁹ concluded that PASG application contributed significantly to the probability of death, and was a greater prognostic indicator of death than age or mechanism of injury. Specifically, the study was conducted in an urban setting with mean transport times of 36 min for the PASG group and 33 min for the non-PASG group, and it permitted the concurrent prehospital administration of large volumes of crystalloid fluid. Of the 784 patients studied, 90 subjects experienced blunt trauma, and their survival rate tended to be higher in the non-PASG group. For the remainder, who experienced penetrating trauma, there was an overall increase in mortality for all patients in the PASG-treated group. In a retrospective study of 226 trauma patients with transport times of 8 min, Mackerzie *et al.*¹⁰ concluded that, although PASG improved blood pressure, there was no demonstrable advantage over conventional management in terms of general clinical status or mortality. Given this apparently contradictory state of affairs, I decided to investigate the present use of PASG in the UK.

METHODS

Using the 1990 *Casualty Surgeons Association Handbook*,¹¹ the consultants of 131 A&E departments seeing more than 40 000 new patients each year were sent a questionnaire requesting information about their use of PASG, both prehospital and within their emergency departments. A second questionnaire was sent if

Correspondence:
M.J. Clancy,
Consultant,
Department of
Accident and
Emergency
Medicine, Bristol
Royal Infirmary,
Bristol BS2 8HW,
UK

RESULTS

Of 131 departments, 100 (76%) responded. PASG was used in-hospital by 19 departments, one of which had only recently acquired 2 of the garments, and the following results relate to the experience of the remaining 18 departments.

Five out of 18 departments (28%) used PASG on *all* patients with pelvic fractures who experienced continued haemorrhage and hypotension despite intravenous (IV) therapy. Two out of 18 departments (11%) used PASG on *all* patients with abdominal trauma who were hypotensive despite IV therapy. The percentage of these patients receiving PASG in the remaining departments, for these two conditions, is shown in Figs 1 and 2.

Fourteen out of 18 departments (78%) said that they did *not* use PASG for patients with ruptured ectopic pregnancies who were in shock despite IV therapy. In contrast, 15 out of 18 departments (83%) said that they did use PASG for patients with bleeding abdominal aneurysms with worsening shock on the way to theatre. In only two of these 18 departments using PASG was their use increasing; in six departments it was decreasing and in the other ten it remained static.

Nine departments used PASG in their prehospital care systems. Instruction on the use of PASG typically lasted for 2 h, but none of the departments had a written protocol for the garments' use. In eight of these nine departments, use was confined to flying squads, helicopters or general practitioners providing immediate care.

Comments made by respondents on the value of PASG varied from 'undoubtedly of value' and 'a very important piece of equipment in any A&E department' to 'dangerous' and 'I don't think they are very useful'. Specific problems identified included difficulty in examining patients, ignorance

of hospital staff regarding their indication and contraindications, and ignorance of their method of application and removal. There was also a reluctance of colleagues from other specialties to adopt their use.

DISCUSSION

It is clear that, within the U K, PASG is used in less than one in five hospitals and one in 10 prehospital systems, and this probably reflects the fact that British clinicians remain unconvinced of the value of PASG. Of those hospitals that were using PASG, less than half treated more than 50% of those patients in the two situations recommended for their use by the 1988 ATLS manual. The lack of demonstrable benefit of PASG in the studies already quoted does not mean that the garment may not be useful in certain subgroups of patients, and this may explain the existence of favourable anecdotal reports. Trauma is not a homogenous disease: different physiological systems are affected to differing degrees which alter over time. PASG affects these systems to an extent which is a function of the site, extent and time of injury. Thus PASG has been consistently shown to elevate blood pressure and, whilst this maybe life saving to those with inadequate cerebral and coronary perfusion, it may accelerate the rate of blood loss in patients who initially had adequate perfusion, and so contribute to their demise. In order to determine whether PASG is of benefit to the patient, intensive monitoring would be necessary, which is unavailable in the prehospital phase and often in the initial in-hospital phase of resuscitation.

The effort required to identify those subgroups of patients, if any, that would benefit from PASG may not be justified against a background of declining use of PASG, the widespread training that would be required, and the additional cost of the

Fig. 1. Percentage of patients who were hypotensive after sustaining pelvic fractures despite IV therapy, who received PASG on those 18 departments using PASG.

Fig. 2. Percentage of patients who were hypotensive after abdominal trauma despite IV therapy, who received PASG in those 18 departments using PASG.

equipment, together with its already recognized morbidity. This scepticism is reflected in the latest revision of the ATLS manual, where PASG is de-emphasized and the PASG skill station has been deleted.¹²

ACKNOWLEDGEMENTS

The author wishes to thank all the respondents who took the time to complete the questionnaire, and the British Association for Accident and Emergency Medicine, who provided financial support for this work.

REFERENCES

1. Crile G.W. (1903) Blood pressure in surgery, In: *Experimental and Clinical Research*. J.B. Lippincot & Co., Philadelphia.
2. Cutler B.S. & Dagget W.M. (1971) Application of the G-suit to the control of haemorrhage in massive trauma. *Annals of Surgery* **173**, 511–514.
3. Kaplan B.C., Civetta J.M., Nagel E.L., Nussenfeld S.R. & Hirschman J.C. (1973) The military anti-shock trouser in civilian pre-hospital emergency care. *Journal of Trauma* **13**, 843–848.
4. Freeman S. (1988) MAST. In: *Emergency Medicine. A Comprehensive Study Guide* (eds Tintinalli J., Krome R.L. & Ruiz E.), pp. 6–9. McGraw-Hill, Inc.
5. Committee on Trauma, American College of Surgeons (1988) *Advanced Trauma Life Support Course*, p. 68. American College of Surgeons, Chicago, Illinois.
6. Norton R. & Frumkin K. (1992) Pneumatic anti-shock garment. In: *Clinical Procedures in Emergency Medicine* (eds Hedges J. R. & Roberts J. R.), pp. 421–431. W.B. Saunders and Co.
7. Gustafson R.A., McDowell D.E. & Savkin R.A. (1983) The use of the MAST suit in ruptured abdominal aortic aneurysms. *The American Surgeon* **49**, 454–459.
8. Mud H.J., Schattenkerk M.E., De Vries J.E. & Bruining H.A. (1987) Non-surgical treatment of pelvic haemorrhage in obstetric and gynaecologic patients. *Critical Care Medicine* **15**, 534–535.
9. Mattox K.L., Bickell W., Pepe P.E., Burch J. & Feliciano D. (1989) Prospective MAST study in 911 patients. *Journal of Trauma* **29**, 1104–1112.
10. Mackersie R.C., Christensen J.M. & Lewis F.R. (1984) The prehospital use of external counterpressure: does MAST make a difference? *Journal of Trauma* **24**, 882–888.
11. Casualty Surgeons Association Handbook (1989)
12. Committee on Trauma, American College of Surgeons (1993) *Advanced Trauma Life Support Course*. American College of Surgeons, Chicago, Illinois.