Anti-shock trousers

Medical anti-shock trousers (MAST), also known as military anti-shock trousers or pneumatic anti-shock garments (PASG), are medical devices made of synthetic inflatable air bladders which are applied to a patient's abdomen, pelvis, and lower extremities.[1] These devices include one abdominal compartment and 2 leg compartments which attach to a pump or inflation unit with valves to control the pressure within each air bladder. The underlying physiologic concept of these devices is simple; apply pressure to the lower extremities to auto-transfuse or shift the patient's blood volume from the abdomen, pelvis, and lower extremities to the upper body and central circulation. At one time it was also thought these devices increased overall peripheral vascular resistance, halted intraabdominal and lower extremity bleeding, and splinted lower extremity fractures. Medical anti-shock trousers were first described in 1903 by surgeon G.W. Crile as he tried to augment blood pressure with a "pneumatic rubber suit" during neurosurgical procedures. Decades later the term military anti-shock trouser was coined during the Vietnam War where medics applied the device in the field before airlifting soldiers out of a combat zone to a hospital for definitive care.[2][3] Upon conclusion of the Vietnam War in 1975 military surgeons and combat medics returned to the United States and advocated for the use of these devices in pre-hospital and critical care settings. In 1977 the Committee on Trauma for the American College of Surgeons listed MAST as essential devices on all ambulances. Throughout the United States in the late 1970s and 1980s MAST devices were the standard of care for hypotensive trauma patients as evidenced by the American College of Surgeons' Advanced Trauma Life Support guidelines.[4][5] These devices utilized heavily through the 1980s and as late as 1996 there were 30 states which required MAST devices on all ambulances.[6] These devices were applied in various settings including aviation, combat, pre-hospital and critical care settings. Despite a period of widespread use, MAST devices have been the subject of much debate and research. Initial studies in the 1970s suggested that as much as 20% of a patient's total blood volume was auto-transfused to the upper body by application of the MAST device.[7][8] Further studies performed in the 1980s, however, refuted these early findings, suggesting that only 5% or less of a patient's overall blood volume was auto-transfused by these devices in both human and dog models.[9][10] During this period there were also studies that showed harmful complications of device use which included compartment syndrome and lower extremity ischemia, amongst others.[11] In 1989, the Houston Fire Department partnered with Ben Taub Hospital to investigate the use of MAST devices in the prehospital environment. This study, which enrolled 201 patients randomized either to MAST application or standard care, did not demonstrate an improvement in mortality rates in penetrating abdominal trauma.[12] Further studies corroborated these findings and could not show a significant difference in the length of hospitalization or intensive care unit stay.[13] Amidst this controversy, the National Association of Emergency Medical Services Physicians published a 1997 position paper citing support for MAST in certain cases including ruptured abdominal aortic aneurysm, pelvic fracture with subsequent hypotension, and severe traumatic hypotension.[14] Of these recommendations, the only high-level evidence, considered Class I, existed for a ruptured abdominal aortic aneurysm.[15] In 2002, a Cochran review demonstrated an increase in intensive care unit length of stay by 1.7 days and concluded there was no evidence to suggest a reduction in mortality from the use of MAST.[5] Given these findings, many hospital systems and EMS agencies gradually abandoned the use of these devices. An article published in the United Kingdom in 1995 suggested that only 1 out of every 5 UK hospitals and 1 out of every 12 UK EMS systems continued to use these devices [1)].

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