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TITLE : EFFECTS OF MAST SUIT ON CENTRAL VENOUS PRESSURE IN THE SITTING POSITION

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Introduction: The antigravity suit (G-suit) has been recommended for elevation of venous pressure to prevent venous air embolism in a patient under going a craniotomy in the sitting position. The results of its use in this situation have not been reliable. This is probably because of either a rapid inflation of the G-suit (within 3 seconds)[1]. or only a one-compartment suit was used [2]. Recently, an increasing number of reports have demonstrated the effectiveness of Military Anti-Shock Trousers (MAST) in the treatment of hemorrhagic shock and intractable adominal bleeding. The MAST suit is a three-compartment apparatus consisting of one compartment for each leg and one compartment for the abdomen, each unit having its own inflation valve. Thus, theoretically the MAST suit should provide more effective and evenly distributed compression. In this study: 1) the effectiveness of the MAST suit in maintaining an elevated venous pressure, and 2) the effect of the MAST suit on respiratory function were evaluated when the suit was slowly and sequentially inflated in a series of neurosurgical patients.

Methods: Sixteen patients (Eleven men and five women; 8 to 50 years of age; 20-80 kg in weight) ASA Class I-II, undergoing posterior fossa or cervical spine surgery in the sitting position were studied. Arterial and venous pressures were measured by direct radial artery and subclavian vein catheterization in all patients. The pressures were measured at the level of the fourth intercostal space when the patient was in the sitting position. The MAST suit was applied prior to the induction of anesthesia. Respiration was controlled mechanically, the tidal volume being 10 ml/kg and the rate 10 breaths /m. Precordial ultrasound and end-tidal CO_2 were monitored continuously for air embolism. The inflation tube of the MAST suit was attached by a T-connector to a water-immersed tube and the other part of the connector to any oxygen flowmeter. In inflating the suit, the leg compartments were inflated first, followed by the abdominal compartment by means of an inflow of oxygen at 4 l/m. Once inflated the suit pressure was maintained at 50 cm H_2O by the outlet water-column bubble valve. Studies were performed during opening and closure of the surgical wound. Arterial, venous, and airway pressures were monitored continuously and recorded. Arterial blood gas determinations were performed before, after, and during inflation of the suit. The suit was deflated in reverse order.

Results: Upon placing the patient into the sitting position without inflation of the MAST suit, central venous pressure (CVP) decreased in all patients from a mean of +2 cm H_2O to a mean of -2 H_2O. There was no change in airway pressure. Arterial pressure decreased from a mean systolic of 120 mm Hg to a mean of 105 mm Hg. When the MAST suit was inflated, over a 2 minute period, to 50 cm H_2O pressure, the CVP increased gradually to a mean of 8 cm H_2O. In all patients, the elevated CVP was sustained with little change as long as the suit pressure was kept constant (Fig 1). The peak inspiratory pressure increased from a mean of 24 cm H_2O to a mean of 28 cm H_2O. Arterial pressure rose from a mean systolic of 105 mm Hg to a mean of 120 mm Hg when the MAST suit was inflated and remained elevated throughout the period of inflation. All parameters returned to control levels when the suit was deflated. No significant changes in arterial blood gases were observed before or after the inflation of the suit.

Discussion: The entry of air into the vascular system from an open vessel in the operative wound is directly related to the level of central venous pressure. When the central venous pressure is high, the risk of venous air embolism is decreased. In contrast to previous studies, the present study demonstrates that central venous pressure rises gradually and predictably with inflation of the MAST suit. The desired level of CVP is easily achieved and maintained. With the suit pressure at 50 cm H_2O (36.5 mm Hg), there was a slight decrease in chest compliance as evidenced by the increase in airway pressure, but pulmonary gas exchange was unaffected. The blood pressure, in accordance with the change in CVP rises with suit inflation and falls to control levels with deflation. We attribute the ability of the MAST suit to maintain the elevated CVP to: 1) a better fitting suit to the legs and abdomen, 2) even distribution of pressure by means of slow inflation, 3) sequential inflation of each of the 3 compartments and 4) maintenance of constant suit pressure. It is, therefore, concluded that the MAST suit is effective in maintaining an elevated venous pressure and probably should continue to be applied to all neurosurgical procedures when the sitting position is employed.

References

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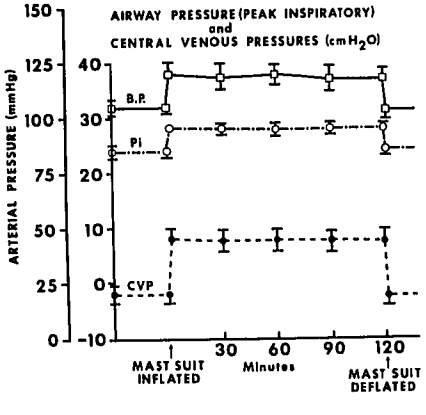

Fig. 1 Pressure alterations produced by 50 cm of water of MAST suit pressure in the sitting position. Values are presented as the Mean± 1 S.E.