APPLICATION OF ELASTIC COMPRESSION BANDAGES TO PREVENT ORTHOSTATIC HYPOTENSION FOLLOWING EXPOSURE TO MICROGRAVITY CONDITIONS. P. A. Johnson[1,2], R. Witiw[2] and A. A. Mardon[2], [1]Department of Medical Sciences, University of Alberta (email: paj1@ualberta.ca) [2]Antarctic Institute of Canada (103, 11919-82 Str. NW, Edmonton, Alberta CANADA T5B 2W4; email: aamardon@yahoo.ca)

Introduction: Nearly all astronauts experience orthostatic intolerance after space flights with about 20% experiencing syncope or presyncope after landing. Apart from loss of consciousness associated symptoms include dizziness, vertigo, blurred or tunnel vision, nausea, headache, or sweating. The underlying cause of these conditions is the sudden shift from microgravity conditions to gravity on a celestial body – a common phenomenon in several space flights. Microgravity induces hypovolemia, a condition where astronauts lose a great deal of their blood volume and thereby influence orthostatic tolerance.

There have been several proposed physiological mechanisms for this body fluid volume loss in microgravity conditions. One widely accepted theory suggests the reduction of a relatively unidirectional gravitational pull enables an increased fluid filtration in the upper body interstitial spaces. Another theory puts forward the peripheral vascular resistance becomes ineffective in microgravity such that there is an imbalance in perfusion leading to a lower preload to the heart. Disregarding this mechanism however, hypovolemia will result in cardiac atrophy which weakens the heart and ultimately results in lower blood pressures affecting the orthostatic balance.

Management of orthostatic intolerance: Orthostatic hypotension is not exclusively a condition affecting astronauts. In fact, it is a common condition in the elderly and those with affected by certain hereditary or non-heriditary cardiovascular conditions. Moreover, there have been several potentially utile proposals for management of orthostatic hypotension in space flights. Currently, the most mentioned treatment on space flight are pharmacological interventions.

The application of compression bandages in the management of orthostatic intolerance is no novelty. In fact, its use is mundane in the elderly to prevent progressive orthostatic hypotension, which is an increasingly common occurrence in the geriatric population during standing. Lower limb compression bandages, in particular, have been demonstrated to be effective in avoiding orthostatic blood pressure reductions. In a study conducted by Podoleanu *et al*, compression pressures ranging from 40 to 60 mmHg utilizing elastic compression bandages in a cohort of patients showed a significantly lower decrease in pressure when compared two different cohort: one without any compression bandages and another with abdominal compression bandages. Moreover, long-term compression stockings therapy is feasible and common for both elderly and patients with venous disorders such as deep vein thrombosis, edema and inflammation of the veins.

Proposed design for space flights: Prior to and throughout the duration of space flights, the authors propose that compression bandages can be adjusted and used to maintain physiological pressures within the body. These modifications would have to account for the microgravity-associated hypovolemia and increased blood loss in the upper body, which suggest the utilization of lower limb compression bandages alone may be ineffective and there is a hidden utility for abdominal or perhaps even upper extremity compression bandages in space flights. A clear advantage in the implementation of compression bandages is its focus on prevention as a means of management instead of treatment after orthostatic intolerance is observed, as is the case with a multitude of pharmacological treatments. In light of economic considerations, compression bandages are both resource-efficient and low-cost. While immensely promising, its conceived use relies extensively on certain underlying assumptions which must be accounted, for feasibility.

Limitations. Perhaps the most critical consideration is its feasibility and lacking evidence in a healthy cohorts where a clear distinction exists in demographic used in current bodies of literature. An exceedingly large number of studies examine orthostatic hypotension in populations of elderly or patients with cardiovascular complication. This suggests the external validity of these studies are weak and require further exploration before its appraisal for space missions. Other potential limitations in this study include the influences of compression bandages on the mobility of astronauts in space flights and its low quality of ergonomics which may create discomfort reducing compliance.

Conclusion: The modification, development and use of compression bandages as an alternative form of management of orthostatic intolerance is conceivable; however, there are a few practical limitations warranting further research before its implementation.

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