

IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)
Interactive Presentations - IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (IP)

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THE POTENTIAL EFFECTS OF SUBORBITAL SPACEFLIGHT STRESSORS ON PASSENGERS
WITH CARDIOVASCULAR COMORBIDITIES: A SYSTEMATIC REVIEW.

Abstract

Background: The commercialisation of spaceflight has meant that space is now accessible to the lay population. However, suborbital spaceflight presents unique challenges to the human body compared to standard air travel. Cardiovascular changes have previously been observed in healthy individuals exposed to microgravity, which makes it crucial to evaluate the impact of microgravity on individuals with cardiovascular comorbidities, including those with implantable cardiac devices. Cardiovascular comorbidities represent one of the most common illnesses in the general population and thus represent important considerations for the safety of commercial suborbital spaceflight.

Objective: To collate evidence regarding the potential effects of suborbital spaceflight stressors on passengers with cardiovascular comorbidities (including implantable cardiac devices) in order to make recommendations for medical requirements for public spaceflight.

Methods: A comprehensive search was conducted across seven international databases. Inclusion criteria encompassed subjects with documented cardiovascular pathology and/or implantable cardiac devices who were subjected to spaceflight stressors. Stressors under consideration included micro- and hypergravity, acceleration/deceleration sequences, pressure changes, vibration, and alterations in oxygen tension. Exclusion criteria involved healthy participants and individuals undergoing long-term spaceflight (defined as more than 24 hours).

Results: From 18,856 search results, six studies were selected for inclusion. These studies examined vital cardiovascular parameters, effects on implanted cardiac devices, and symptom changes. Most studies utilized a centrifuge for simulations. The studies included three case studies, two prospective cohort studies, and one retrospective observational study. The average age of participants ranged from 36 to 79 years, with a male-dominated population (average ratio of 3:1 Male:Female). Cardiovascular diseases identified within the tested population included structural defects, arrhythmias, and previous myocardial infarction. The results were used to extrapolate a decision-making matrix for aeromedical specialist doctors to ensure that suborbital space flight passengers with cardiac comorbidities were risk stratified appropriately and given the correct advice based on this systematic literature review.

Conclusion: Individuals with well-controlled cardiovascular comorbidities, including implantable cardiac devices, are likely to tolerate the stressors of suborbital spaceflight. Chest discomfort was noted in simulated suborbital flights, but participants generally withstood simulated microgravity well. Nevertheless, preflight screening by aerospace medicine specialists is recommended to ensure participant safety. Further research is needed to address the limitations of the included studies and further enhance the decision-making tool proposed in this paper.