

Introduction

- Atrial fibrillation (AF) is a common arrhythmia, caused by asynchronous electrical activity, which is easily managed on Earth.
- The challenging space environment gives rise to well established changes in cardiovascular physiology.
- Exploration class missions are being planned, with a return trip to Mars likely taking over a year.

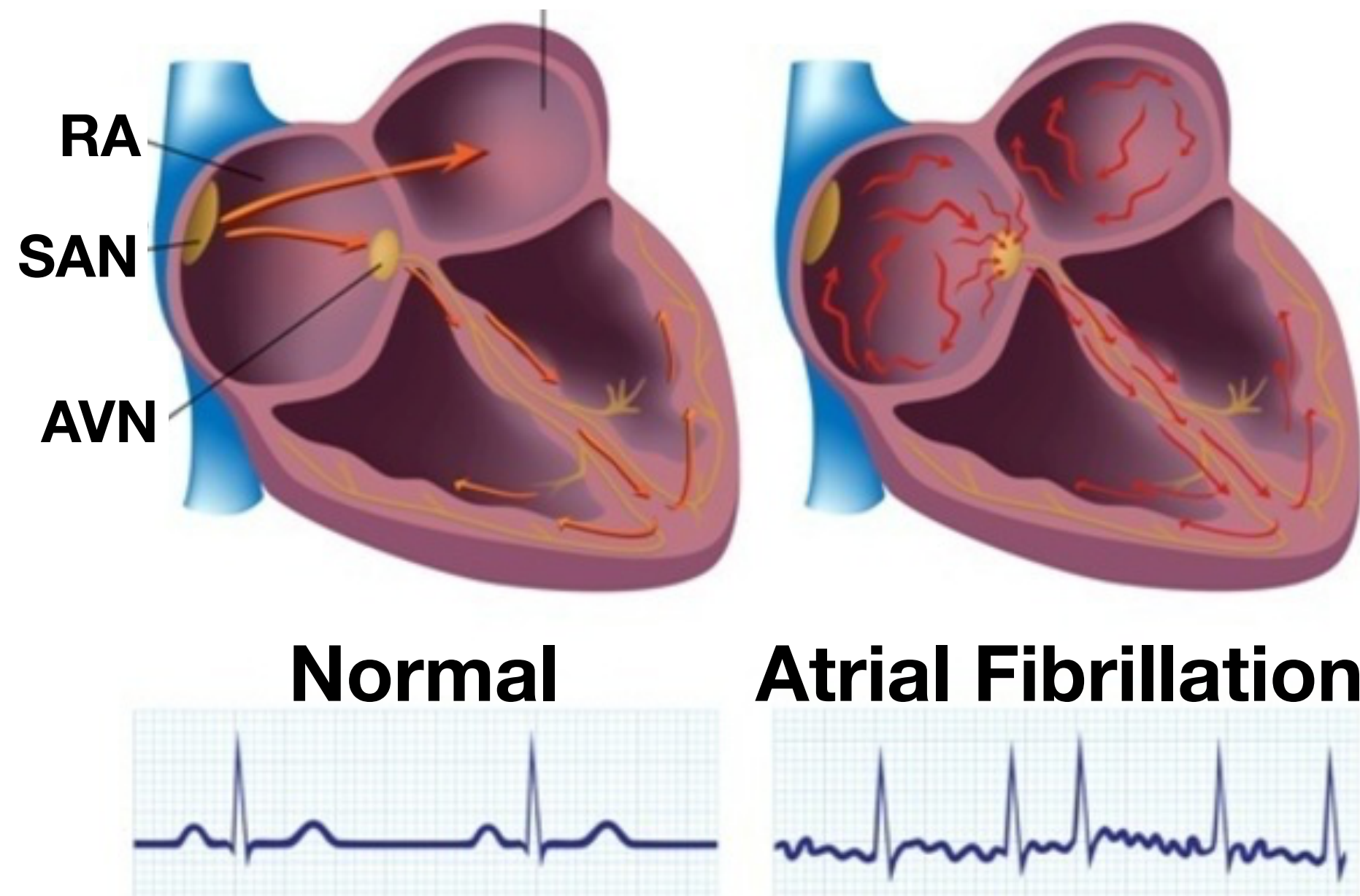


Figure 1: Diagram of electrical conduction and ECG traces in normal and AF affected hearts. Adapted from Alila Medical Media (2011)

Objectives

- Conduct a literature review to determine associations between spaceflight and AF
- Make recommendations for prevention, management and treatment of AF during exploration class missions

Background

- The thoracic shift in body fluid causes a reduction in circulating blood volume.

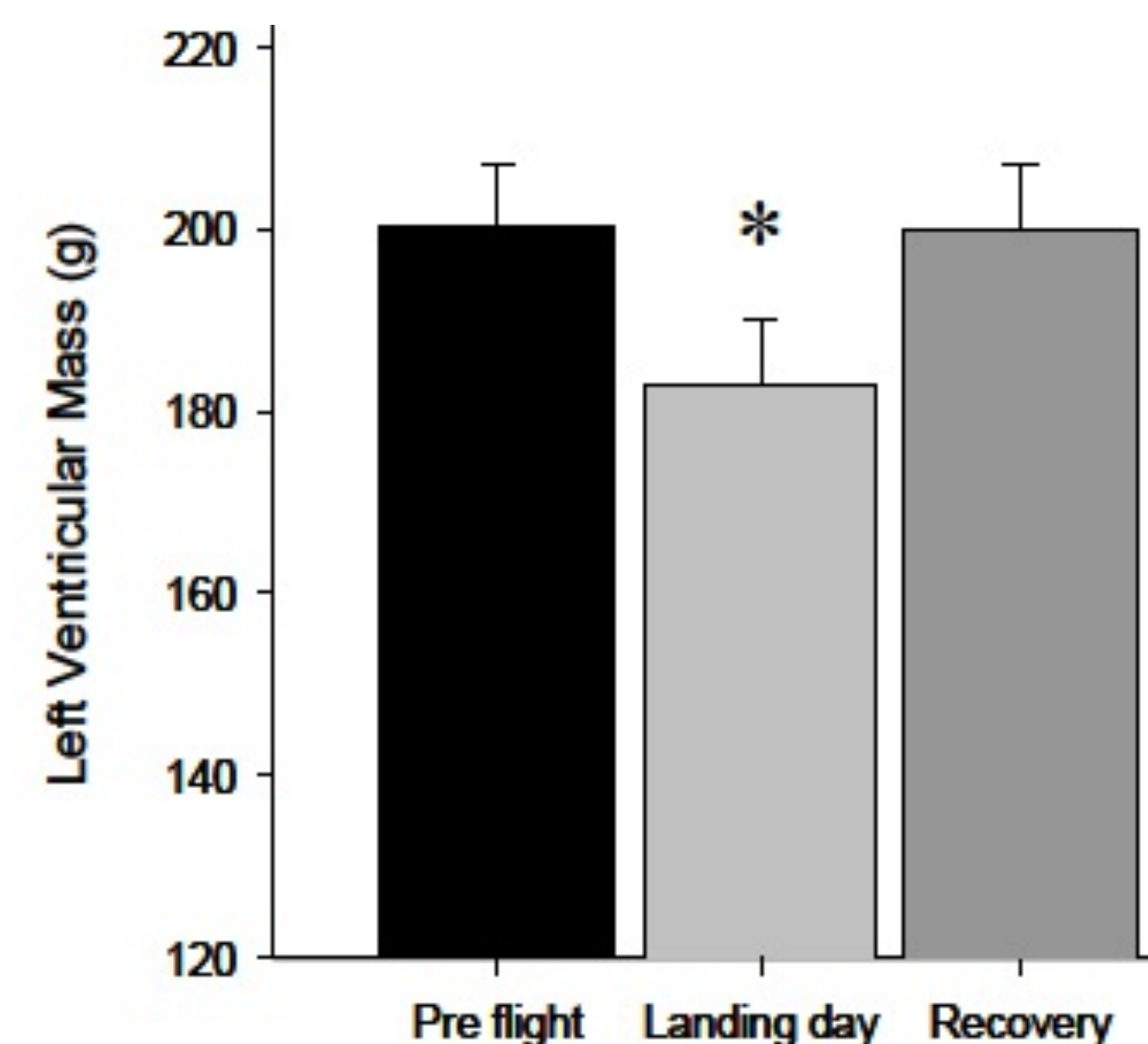
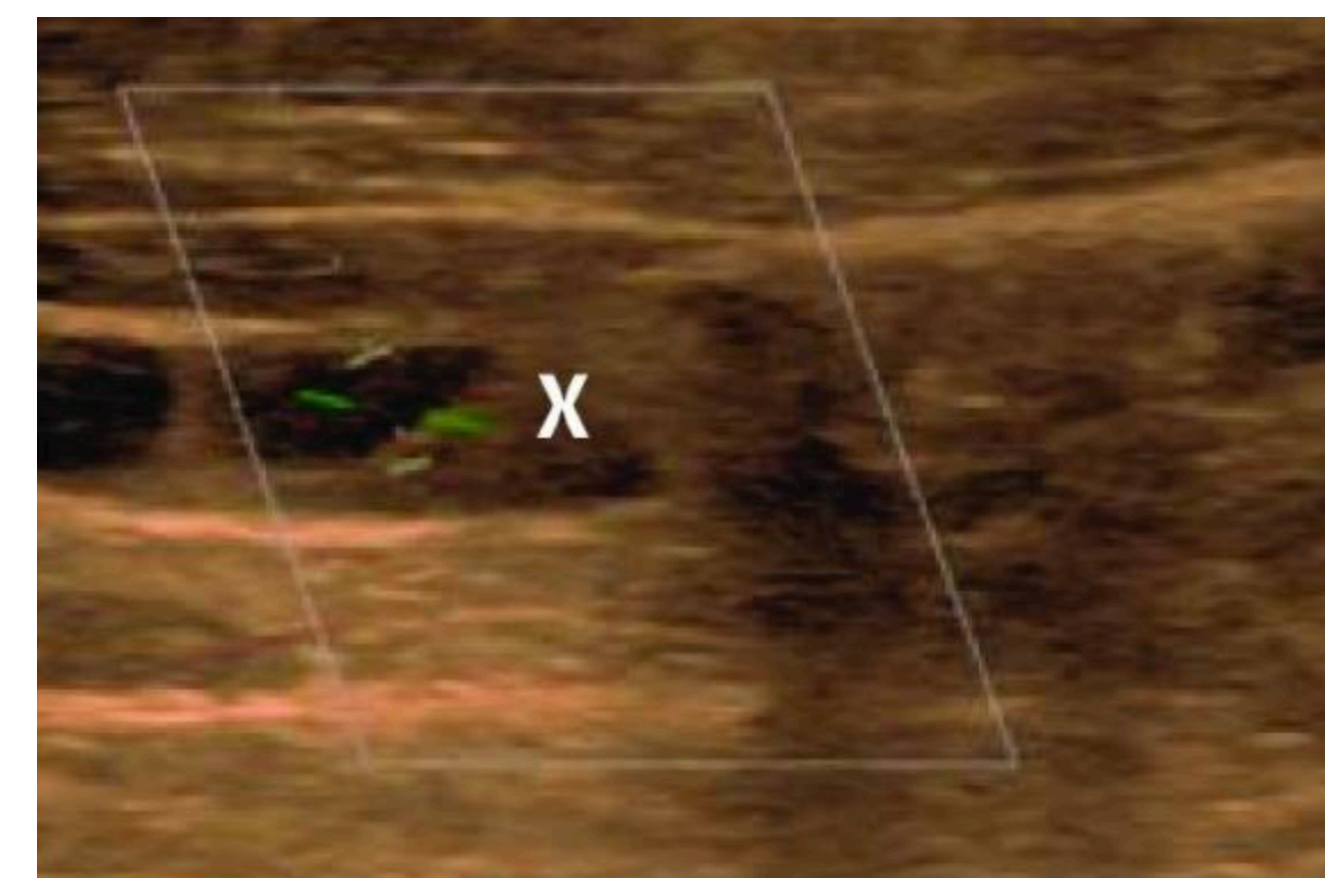


Figure 2: Comparison of left ventricular mass before, during and after spaceflight in data from 38 astronauts. (Summers et al., 2005)

- Cardiac myocytes show altered beating patterns and calcium-recycling patterns.

Figure 3: Ultrasound scan of an astronaut's left internal jugular vein showing occlusion by a thrombus (X), likely due to blood stasis (Marshall-Goebel et al., 2019)



- Radiation levels outside of the magnetosphere will be significantly higher, which could cause microvascular damage.
- Cardiac arrhythmias have been noted in astronauts, including increased QT intervals and ventricular tachycardia.

Summary

- Medical selection should exclude those with a history of AF and CVD. Pre-flight ECGs and echocardiograms should be completed.
- All crew should be trained to manage common conditions and emergencies.
- A crew member with advanced medical knowledge and experience would assist in the need for greater autonomy.
- Regular in-flight cardiovascular examinations and investigations should be performed.
- In haemodynamically unstable AF, amiodarone delivered intraosseously could be first line. Otherwise, rate control could be preferable.
- Anticoagulation, balanced with bleeding risk, should be administered if AF occurs.
- Crew must be self-sufficient given the inability to resupply or evacuate.

Conclusion

- Further investigations of whether spaceflight is associated with arrhythmias is warranted.
- The space environment poses additional challenges in the management of AF, and an integrated approach between engineering, medicine and technology is required.

Key References

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