INTRODUCTION: Percutaneous drains (PDs) have been described as the most important intervention available for stabilizing patients with intra-abdominal abscesses occurring during long-duration spaceflight. Percutaneous aspiration of intra-abdominal fluid has been successfully performed in porcine experiments in microgravity. However, ongoing drainage of abscesses within the microgravity environment, beyond the initial aspiration, has not yet been investigated. With the advent of commercial spaceflight, transport of patients with PDs in situ could occur. It is therefore important to understand within the microgravity environment the mechanism of fluid flow from an abscess by a PD in order to maximize drainage efficiency. The aim of this study was to analyze flow of fluid through a PD in a simulated microgravity environment. METHODS: A closed drainage system was set outside and within a water tank to simulate low gravity. The system had a cavity simulating intra-abdominal pressure, with a multipurpose PD (10.2Fr) inserted into the cavity and a collecting chamber measuring volume output over time. Water was used as standard fluid. Three suction levels were used: 334 to -517 Torr. Amys fluid dynamics software was used to corroborate the experimental results and test simulated blood flow through the drain. RESULTS: Flow of fluid through a 10.2Fr PD in normogravity without suction was 42ml/min whereas in microgravity this was significantly reduced by 80% to 8ml/min. At -517 Torr it was 412ml/min reducing 40% to 270ml/min in the microgravity setting. Fluid flow velocity and volume output was reduced with increased viscosity of fluid (blood). The significantly reduced drainage under microgravity was predicted by computational modelling and this closely confirmed the findings from the experimental testing. DISCUSSION: The maintenance of abscess cavity drainage in a microgravity environment will require a constant suction vacuum to sustain accurate drainage rates. There is room for significant advancement in design concept of PD in microgravity.

Learning Objectives:
1. The use of percutaneous drains to maintain abscess drainage in a low gravity environment requires continuous suction.
2. The fluid flow of bodily fluids through a percutaneous drain in a low gravity environment is dramatically reduced compared with that at normogravity.

[017] CHALLENGES ENCOUNTERED USING OPHTHALMIC ANESTHETICS IN SPACE MEDICINE
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INTRODUCTION: On orbit, ophthalmic anesthetics are used for tonometry and off-nominal corneal examinations. Proparacaine has been flown traditionally. However, the manufacturers recently changed the storage requirements from room temperature storage to refrigerated storage to preserve stability and prolong the shelf-life. Since refrigeration on orbit is not readily available and there were stability concerns about flying proparacaine unrefrigerated, tetracaine was selected as an alternative ophthalmic anesthetic in 2013. We will discuss the challenges encountered flying and using these anesthetics on the International Space Station. METHODS: The NASA Johnson Space Center Pharmacy Team researched the stability of the proparacaine under room temperature conditions. A comparison between proparacaine and tetracaine was provided to the operational flight surgeons, who approved tetracaine for use in microgravity. RESULTS: Tetracaine began flying in crewmembers’ individual medical accessory kits before it was permanently incorporated into the standard medical kit. Tetracaine was used on five crewmembers as a topical anesthetic for tonometry during this timeframe. Two of the five crewmembers experienced corneal flushing and scleral injection, which interfered with interpretation of on-orbit surveillance testing results. Corneal flushing and scleral injection have not been noted with use of proparacaine. These findings required a switch back to proparacaine, necessitating a new process to be developed to supply the medication refrigerated. DISCUSSION: Storage requirements of medications in spaceflight are important factors to consider. In the absence of stability data, performance of the medication and/or the diagnostic testing may be affected. Selection of medications for future exploration missions will need