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EMERGENT SURGERY ON DEEP SPACE MISSIONS: A CURRICULAR MODEL FOR
PROCEDURAL TRAINING, PRACTICE, AND REAL-TIME GUIDANCE**Abstract****INTRODUCTION**

Surgical disease poses profound risk to individuals on long-duration missions in austere environments, to include deep space. Crew Medical Officer (CMO) proficiency in select surgical procedures is critical for astronaut safety in spaceflight beyond low-Earth orbit; crews on Mars will experience communication delays exceeding 20 minutes, prohibiting interaction with terrestrial resources during surgical emergencies. A concise, targeted surgical training protocol is necessary to ensure crew preparedness.

METHODS

An in-depth PubMed literature review encompassed over sixty papers (1996-2018) pertaining to surgery in remote and resource-limited environments, identifying the procedures most critical for ensuring crew health and safety. The protocol designed incorporates principles of laparoscopic and endoscopic training published by SAGES and ultrasound guidance outlined by the AIUM.

RESULTS

NASA's Integrated Medical Model outlines the 100 conditions most likely to develop in-flight, 26 of which may require surgical intervention; the likelihood of a surgical event among a 4-member crew during a 3-year Mars mission nears 18

CONCLUSIONS

A surgical protocol for deep space missions should provide an efficient and versatile platform for training of the CMO. Such a program may be useful in a multitude of austere environments with limited access to formal surgical education.