

## Station 6: International Space Station ... Station



“Ultrasound has been used in some remote areas where it is not feasible to have a clinician with specialized training present. The International Space Station (ISS) is probably the epitome of remote locations, and the National Aeronautics and Space Administration pioneered remote telemonitored ultrasound, which uses live video streaming of ultrasound examinations performed by nonmedical personnel and reviewed by clinicians in real-time on Earth.”<sup>1</sup>



Dr. Koch



Water as coupling medium in microgravity



Dr. Cassada

To date there have been 33 NASA astronauts from the state of Michigan.<sup>3</sup> Most recently, Michigan-born Dr. Christina Koch is a historic NASA astronaut and engineer who served as a Mission Specialist on the Artemis II mission to the Moon. She made history as the first woman ever to travel beyond low-Earth orbit and holds the record for the farthest distance any woman has traveled from Earth

Another Michigan born astronaut, Dr. Josh Cassada recently returned from the International Space Station and interestingly reports to the Detroit SonoW.A.R. that ultrasound in microgravity is unique in that gel is not required – water alone is sufficient as a coupling medium since it stays in place due to surface tension!

Ultrasound is the only medical imaging device currently available on board the International Space Station. In addition, the lack of routine physician expertise on board the ISS makes diagnosis of medical conditions challenging. **For this station, you will be taking the role of a land-based physician guiding a team of astronauts through an emergent medical situation on the ISS.**



References and interesting things to discuss en route to this station:

1. Gharahbaghian, L et al. *Point-of-Care Ultrasound in Austere Environments: A Complete Review of Its Utilization, Pitfalls, and Technique for Common Applications in Austere Settings*. Emergency Medicine Clinics of North America, 2017. <https://pubmed.ncbi.nlm.nih.gov/28411935/>
2. Johnson, M. *Bringing Space Station Ultrasound to the Ends of the Earth*. NASA.gov website, 2019. [https://www.nasa.gov/mission\\_pages/station/research/news/b4h-3rd/hh-bringing-space-station-ultrasound](https://www.nasa.gov/mission_pages/station/research/news/b4h-3rd/hh-bringing-space-station-ultrasound)
3. Michigan Astronauts. Website, accessed My 2023. <https://www.minspacegrant.org/connect/michigan-astronauts/>
4. Fu Q, et al. *Impact of Spaceflight on Blood Pressure*. Circulation, 2019. <https://www.ahajournals.org/doi/10.1161/CIRCULATIONAHA.119.041050>
5. Aunon-Chancellor, S et al. *Venous Thrombosis during Spaceflight*. New England Journal of Medicine, 2020. <https://www.nejm.org/doi/full/10.1056/NEJMc1905875>
6. Driver, et al. *Emergency Ultrasound diagnosis of internal jugular vein thrombosis*. Critical Ultrasound Journal, 2010. <https://theultrasoundjournal.springeropen.com/articles/10.1007/s13089-010-0046-z>
7. Simka, M et al. *Blood flow in the internal jugular veins during spaceflight – is it actually bidirectional?* Life sciences in Space Research, 2020.

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1 Point      Navigate to this location and complete it within 10 minutes

One of the crewmembers on the ISS is noted to be hypotensive with BP 85/60.<sup>4</sup> You must use telemedicine to talk the crew through a RUSH exam. Your team member performing the exam will not be able to see the screen, and must rely on their teammates to talk them thorough the image acquisition.

1 Point      What can ultrasound identify that could be making this astronaut hypotensive? I.e, what are the components of the RUSH exam?

1 Point



1 Point      Identify and assess the patient's IVC

1 Point      Identify and assess the patient's RUQ / Morrison's pouch. What location is the most sensitive for free fluid in the abdomen?

1 Point      Identify and assess the patient's aorta in long axis

1 Point      Identify bilateral lung sliding at the midclavicular line using m-mode

A landmark case was noted in 2019 when an otherwise healthy astronaut who was 2 months into a mission aboard the International Space Station was noted to have an obstructive L internal jugular venous thrombus.

1 Point      Using telemedicine guidance, scan your patient's Left IJ as part of the now routine vascular check aboard the ISS

1 Point      The Mueller maneuver (opposite of Valsalva) is important in microgravity to augment intrathoracic pressure. Predict and demonstrate with the effect of the Mueller maneuver will have on your IJ

1 Point      Describe 3 ways one can confirm the presence of thrombosis using POCUS