Detroit SonoWAR 2023

#8 International Space Station Station

“Ultrasound has been used in some remote areas where it is not feasible to have a clinician or even a technician 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 (RTUS), which uses live video streaming of ultrasound examinations performed by nonmedical personnel and reviewed by clinicians in real-time on Earth.” [1]

Dr. Cassada

Water as coupling medium in microgravity

Dr. Koch

The Advanced Diagnostic Ultrasound in Microgravity (ADUM) experiment was developed by Detroit area physicians in the early 2000’s, which guided astronauts remotely to obtain a wide variety of diagnostic quality medical images, “demonstrating the effectiveness of ultrasound as a multipurpose, remote diagnostic tool in space.”[2]

To date there have been 33 NASA astronauts from the state of Michigan.[3] Most recently, Dr. Josh Cassada returned from the International Space Station earlier this year 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!

Another Michigan born astronaut, Dr. Christina Koch, is up next for NASA and will be travelling to the moon as part of the upcoming Artemis II program.

Ultrasound is the only medical imaging device currently available on board the International Space Station. In addition, the lack of 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
3. Michigan Astronauts. Website, accessed My 2023. https://www.mispacegrant.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.

1 Point Navigate to this location

One of the crewmembers on the ISS is noted to be hypotensive with BP 85/60.[4] 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 Identify and assess the patient's EF on ultrasound using at least two methods

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 thrombosis.

1 Point Using telemedicine guidance, scan your own 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

Bonus Point: Tweet a photo with your team name for this station (and an action shot) with ***#SonoWAR*** *to have a bonus point added on the back end!*