A Medical Simulation Based Curriculum to Address Medical Contingencies Aboard the International Space Station

Dawn Y. Lim
PGY-3, FRCP Emergency Medicine
University of Toronto
October 25, 2007

Special Acknowledgements

- Victor Hurst
- Doug Hamilton
- Janine Bolton
- Kim So
- Elisca Hicks
- Eleasa Kim
- Raffi Kuyumjian

Objectives

- Understand the role of international partner flight surgeons (IP-FS) and biomedical engineer flight controllers (BME) during medical contingencies aboard the ISS
- Sample the curriculum
- Work through an interesting case

Why do we do simulations?

Background

- What are the responsibilities of an IP-FS?
- What are the responsibilities of a BME?

International Partner Flight Surgeons (IP-FS)

- Flight surgeons from ISS partner agencies
- When do they get involved?
- Responsibilities
  - Daily medical responsibilities
  - Liaison with partner agency mission control
  - Coordinate medical activities with crew surgeon

Curriculum for IP-FS

- Life-threatening events that require immediate medical attention
- Scenarios involving collaborative decision making with other team members
- A cultural scenario to elucidate differences in medical practice

Biomedical Engineer Flight Controllers (BME)

- Position on console
- On-call duties
- Knowledgeable about:
  - Hardware and systems on board
  - Procedures commonly used
  - BME log
  - Contingency operations and troubleshooting
- Restrictions

Curriculum for BME

- Information gathering
- How to contact medical support
- How to prepare and troubleshoot the necessary hardware and procedures required by the medical team

Case of A.S.M. Clerk

- Scenario:
  - You are the BME sitting on console today
  - It is 0400 hrs GMT on a Saturday
  - 37 year old previously healthy female RSA cosmonaut on the International Space Station starts to complain of gradual onset of right lower-quadrant pain

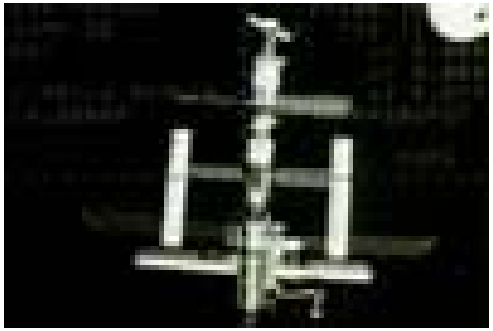
Question: What would you like to do now?

BME Considerations

- Contact the Russian IP-FS or Crew surgeon (Lead U.S. Flight Surgeon)
- Arrange for a PMC via space-to-ground voice loop
- What information would be relevant now?
  - PMHx and FHx of the cosmonaut
  - What has been done by the CMO so far?
  - What support does the CMO need now?
  - What is the situation with the mission now?
  - What is the window for a contingency return?
  - What equipment might the IP-FS request?
  - Are translation resources necessary?

Situation Onboard

- The crew is in the second month of a six-month mission aboard the ISS
- Next shuttle resupply is in three weeks
- Next window for a nominal landing in Kazakhstan via the Soyuz is in 8 hours



To Further Complicate Matters…

The sick cosmonaut is the Soyuz commander

But Luckily…

There is a healthy CMO on board as well as a third ISS crewmember with Soyuz landing training

IP-FS Considerations

- What is the medical concern?
- Will this sickness impact other crewmembers?
- Will this sickness impact the mission?
- What investigations and treatments should be administered now?
- When should this be discussed with the crew surgeon and flight director?

Medical Situation On Board (continued)

- Cosmonaut is previously healthy woman, G3 T2 P1 A1 L2, on multivitamins and calcium supplements
- FHx of diabetes, heart disease, kidney stones
- Has been drinking less than 2L/d of water
- Has colicky RLQ abdominal pain
- Mild irritative urinary symptoms

Physical Exam

- Cosmonaut looks pale, diaphoretic, anxious, in distress, writhing in pain
- Vital signs: 140/85, 120, 26, 100% non-rebreather, 37.9 °C
- Could not assess bowel sounds because stethoscope misplaced, mild RLQ tenderness, +CVAT RHS, no rebound/guarding/rigidity/peritoneal signs
- Rest of physical exam is normal

Question: As the IP-FS, what would you do now?

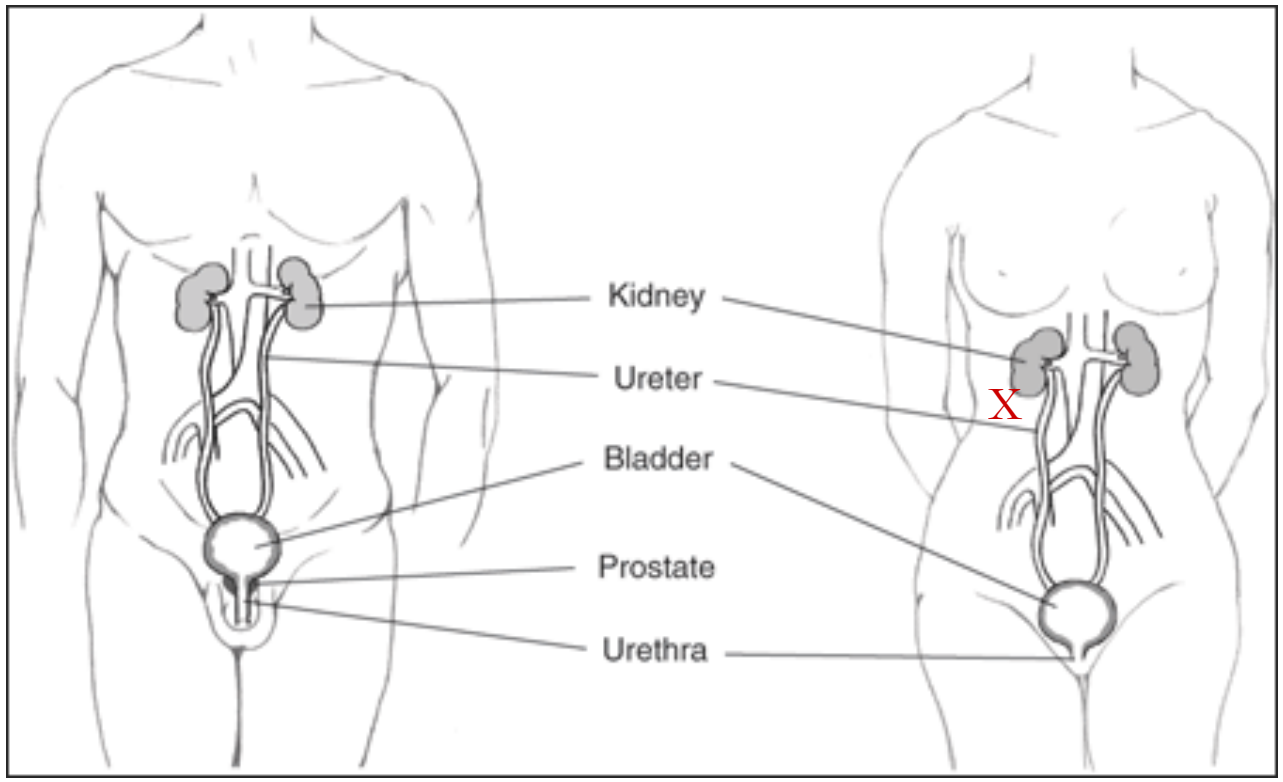
IP-FS Considerations Continued

- Possible mission impacting event
- Need to notify the crew surgeon, deputy crew surgeon, and flight director
- In conjunction with the BME, activate the Health Research Facility ISS ultrasound and the on-call radiologist and make sure the appropriate medications are available to keep the cosmonaut comfortable

Developments

- Crew Surgeon has arrived on scene and notified the flight director of the events
- Crew Surgeon) asks you what has been done thus far and asks what you think should be done at this point
- Flight director needs to make a decision regarding Soyuz return in 3 hours

Urine analysis:
(+) or positive for leukocytes and nitrites

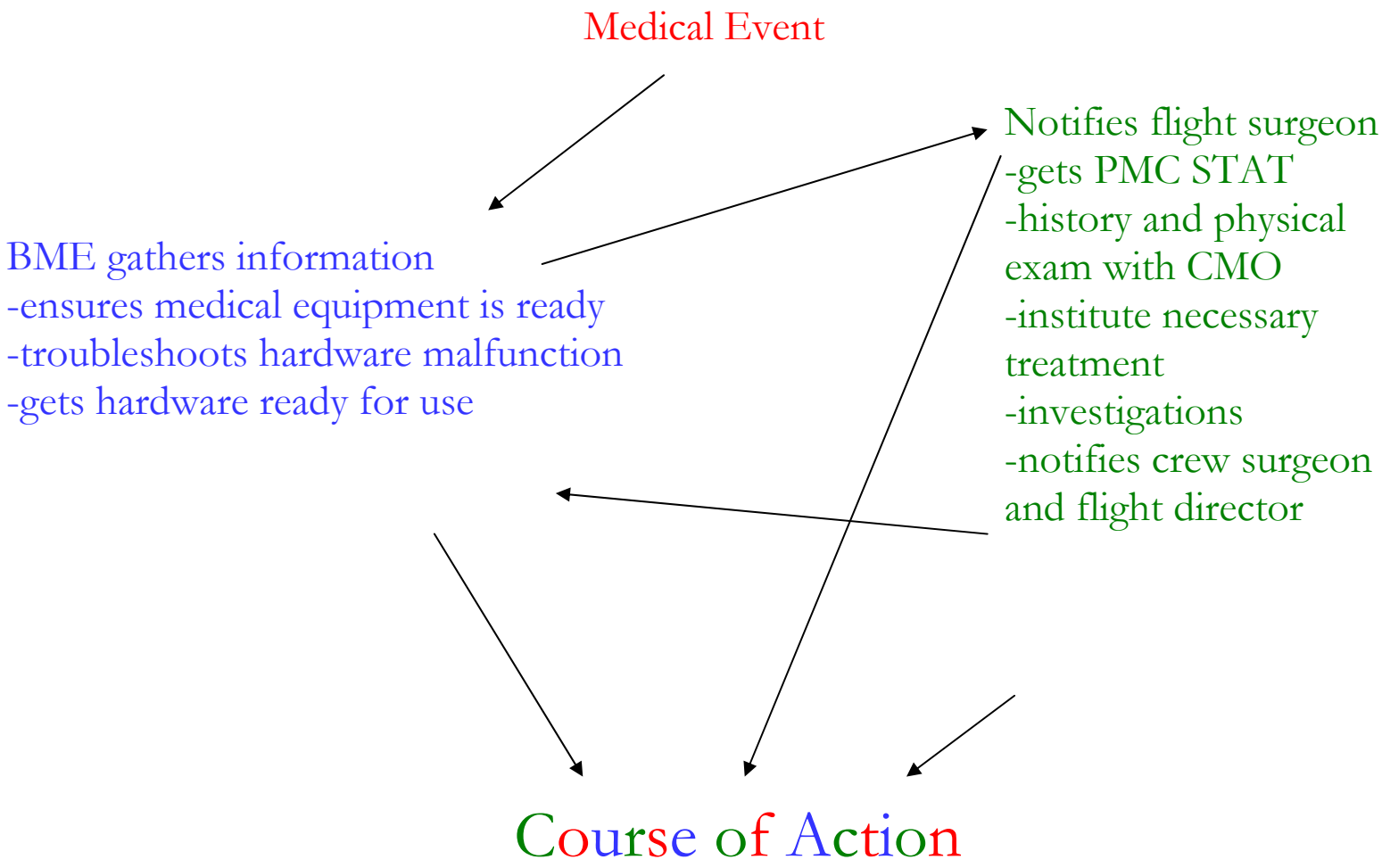


Imaging Results

- Dilated right renal calyx, echogenic mass in proximal right ureter, absence of ureteral jets with doppler
- No obvious vascular, gastrointestinal and ovarian abnormalities

As an IP-FS working with the crew surgeon, what are the different options now?

Activation of Medical Supports



Summary

- Contingencies aboard the ISS have the potential to get very complicated
- Many medical team members work together to come to a medical decision
- Simulation exercises attempt to strengthen these decision-making processes by mimicking high-pressured situations that might occur on board

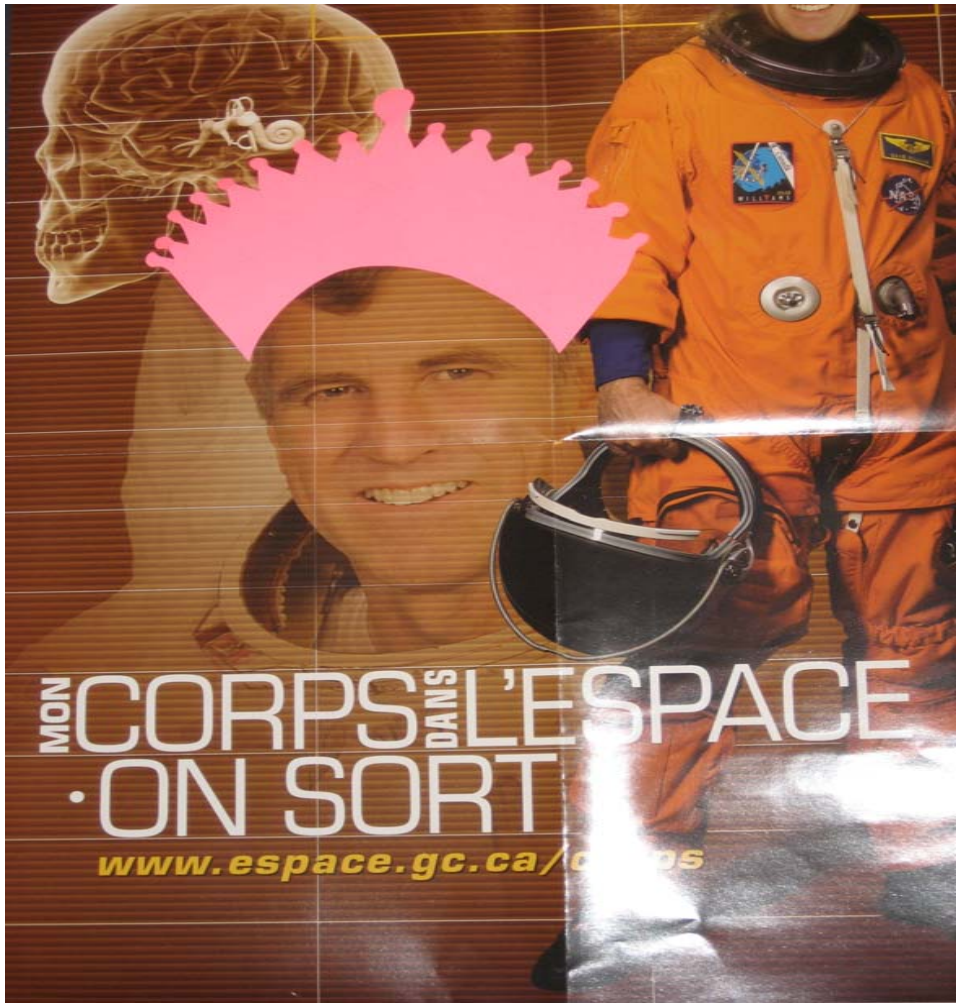
Future Directions

- Present the curriculum proposal to partner agencies for feedback
- Validate the curriculum

References

- International Partner Flight Surgeons Training Manual
- Biomedical Engineer Certification Guide
- International Space Station Crew Training and Certification Plan
- International Space Station Medical Checklist
- International Space Station Crew Medical Officer Certification Training

Any Questions?



Courtesy of the Canadian Space Agency