Malignancy

From HumanResearchWiki

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Introduction

A malignancy, or cancer, is a collection of cells within the body whose genetic makeup has changed and consequently grows out of control. Some of the many risk factors include genetic/hereditary factors, environmental toxins and organisms (including excessive alcohol ingestion and tobacco use) and radiation. While the etiologies of all cancers have not been identified, some malignancies are linked to known risk factors, i.e., lung cancer and smoking.

The nature of a malignancy leads to its ability to invade other tissues or regions of the body (metastases). Current technology allows preventative screening for only some cancers. Most are diagnosed as incidental findings during other medical testing or in patients who become symptomatic leading to a thorough medical evaluation. Upon diagnosis, cancer staging is done to determine if and to what extent the malignancy has spread beyond the tissue’s normal borders. With this information a physician may go ahead and initiate treatment. Some cancers have excellent treatment responses, while others do not and may cause death.

Clinical Priority and Clinical Priority Rationale by Design Reference Mission

One of the inherent properties of space flight is a limitation in available mass, power, and volume within the space craft. These limitations mandate prioritization of what medical equipment and consumables are manifested for the flight, and which medical conditions would be addressed. Therefore, clinical priorities have been assigned to describe which medical conditions will be allocated resources for diagnosis and treatment. “Shall” conditions are those for which diagnostic and treatment capability must be provided, due to a high likelihood of their occurrence and severe consequence if the condition were to occur and no treatment was available. “Should” conditions are those for which diagnostic and treatment capability should be provided if mass/power/volume limitations allow. Conditions were designated as “Not Addressed” if no specific diagnostic and/or treatment capability are expected to be manifested, either due to a very low likelihood of occurrence or other limitations (for example, in medical
training, hardware, or consumables) that would preclude treatment. Design Reference Missions (DRMs) are proposed future missions designated by a set of assumptions that encompass parameters such as destination, length of mission, number of crewmembers, number of Extravehicular Activities (EVAs), and anticipated level of care. The clinical priorities for all medical conditions on the Exploration Medical Condition List (EMCL) can be found here (https://humanresearchwiki.jsc.nasa.gov/index.php?title=Category:All_DRM). The EMCL document may be accessed here (https://humanresearchwiki.jsc.nasa.gov/images/6/62/EMCL_RevC_2013.pdf).

<table>
<thead>
<tr>
<th>Design Reference Mission</th>
<th>Clinical Priority</th>
<th>Clinical Priority Rationale</th>
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<tbody>
<tr>
<td>Lunar sortie mission</td>
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<tr>
<td>Assumptions:</td>
<td>Not Addressed</td>
<td>Assuming that extensive preflight screening is employed, and that mission length is no longer than 12 to 15 months, disabling malignancies manifesting during the mission would be unlikely.</td>
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<tr>
<td>4 crewmembers (3 males, 1 female)</td>
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<td>14 days total</td>
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<tr>
<td>4 EVAs/crewmember</td>
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<tr>
<td>Level of Care 3</td>
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<td>Lunar outpost mission</td>
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<tr>
<td>Assumptions:</td>
<td>Not Addressed</td>
<td>Assuming that extensive preflight screening is employed, and that mission length is no longer than 12 to 15 months, disabling malignancies manifesting during the mission would be unlikely.</td>
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<td>90 EVAs/crewmember</td>
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<td>Level of Care 4</td>
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<tr>
<td>Near-Earth Asteroid (NEA) mission</td>
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<td>Assumptions:</td>
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<td>Assuming that extensive preflight screening is employed, and that mission length is no longer than 12 to 15 months, disabling malignancies manifesting during the mission would be unlikely.</td>
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<td>30 EVAs/crewmember</td>
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<td>Level of Care 5</td>
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**Initial Treatment Steps During Space Flight**
A link is provided to a prior version of the International Space Station (ISS) Medical Checklist, which outlines the initial diagnostic and treatment steps recommended during space flight for various conditions which may be encountered onboard the ISS. Further diagnostic and treatment procedures beyond the initial steps outlined in the Medical Checklist are then recommended by the ground-based Flight Surgeon, depending on the clinical scenario. Please note that this version does not represent current diagnostic or treatment capabilities available on the ISS. While more recent versions of this document are not accessible to the general public, the provided version of the checklist can still provide a general sense of how medical conditions are handled in the space flight environment. Medical Checklists will be developed for exploration missions at a later point in time.

Please note this file is over 20 megabytes (MB) in size, and may take a few minutes to fully download.

ISS Medical Checklist (http://www.nasa.gov/centers/johnson/pdf/163533main_ISS_Med_CL.pdf)

Capabilities Needed for Diagnosis

The following is a hypothetical list of capabilities that would be helpful in diagnosis. It does not necessarily represent the current capabilities available onboard current spacecraft or on the ISS, and may include capabilities that are not yet feasible in the space flight environment.

- Imaging [such as ultrasound, Computed Tomography (CT) scan or Magnetic Resonance Imaging (MRI)]
- Biopsy [fine needle aspiration (FNA), core, excisional]
- Sample preparation (fixation, staining, other prep)
- Microscopy
- Telepathology

Capabilities Needed for Treatment

The following is a hypothetical list of capabilities that would be helpful in treatment. It does not necessarily represent the current capabilities available onboard current spacecraft or on the ISS, and may include capabilities that are not yet feasible in the space flight environment.

- Surgical resection capability
- Chemotherapeutics
- Radiotherapy
- Embolization
- Ablation
- Hormonal therapy

Associated Gap Reports

The NASA Human Research Program (HRP) identifies gaps in knowledge about the health risks associated with human space travel and the ability to mitigate such risks. The overall objective is to identify gaps critical to human space missions and close them through research and development. The gap reports that are applicable to this medical condition are listed below. A link to all of the HRP gaps can be found here (http://humanresearchroadmap.nasa.gov/Gaps/).

1.01 - We do not know which emerging technologies are suitable for preflight medical screening for exploration missions.
2.01 - We do not know the quantified health and mission outcomes due to medical events during exploration missions.
2.02 - We do not know how the inclusion of a physician crew medical officer quantitatively impacts clinical outcomes during exploration missions.
3.01 - We do not know the optimal training methods for in-flight medical conditions identified on the Exploration Medical Condition List taking into account the crew medical officer’s clinical background. (Closed)
3.03 - We do not know which emerging technologies are suitable for in-flight screening, diagnosis, and treatment during exploration missions.
4.01 - We do not have the capability to provide a guided medical procedure system that integrates with the medical system during exploration missions.
4.02 - We do not have the capability to provide non-invasive medical imaging during exploration missions.
4.03 – Limited capability to treat back/neck pain and injuries in the space flight environment
4.04 – We do not have the capability to deliver supplemental oxygen to crew members while minimizing local and cabin oxygen build-up during exploration missions.
4.05 - We do not have the capability to measure laboratory analytes in a minimally invasive manner during exploration missions.
4.14 - We do not have the capability to track medical inventory in a manner that integrates securely with the medical system during exploration missions.
4.15 - Lack of medication usage tracking system that includes automatic time stamping and crew identification
4.17 - We do not have the capability to package medications to preserve stability and shelf-life during exploration missions.
4.24 - Lack of knowledge regarding the treatment of conditions on the Space Medicine Exploration Medical Condition List in remote, resource poor environments (Closed)
4.25 - We do not have the capability to deliver injectable medication to a suited crewmember during exploration missions. (Gap on hold)
4.27 - We do not have the capability to sterilize medical equipment during exploration missions.
5.01 - We do not have the capability to comprehensively manage medical data during exploration missions.

Other Pertinent Documents

List of Acronyms

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<tr>
<td>C</td>
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<td>E</td>
<td>EMCL</td>
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<td></td>
<td>EVA</td>
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F
FNA Fine Needle Aspiration

H
HRP Human Research Program

I
ISS International Space Station

M
MB Megabyte
MRI Magnetic Resonance Imaging

N
NASA National Aeronautics and Space Administration
NEA Near Earth Asteroid

References

Last Update

This topic was last updated on 8/12/2014 (Version 2).


Category: Medical Conditions

- This page was last modified on 12 August 2014, at 15:44.