

Abdominal Wall Hernia CLIFF

1. *Strength of evidence presented in CLIFF in modeling the characteristics and mission impact of this medical condition within the spaceflight environment?*

Score: 3

Grading Scale:

4 - *Confident*

3 - *Somewhat confident*

2 – *Neutral*

1 – *Somewhat unconfident*

0 – *Not confident*

2. <i>How confident are you that these data accurately represent the spaceflight environment?</i>	Tables 1, 2 <i>Composite Incidence and Level of Confidence</i>	Table 3, 4 <i>BC/WC Loss of Crew and probability</i>	Table 4 - <i>Clinical Phase 1, 2 durations</i> Table 5 – CP <i>2 Loss of Crew</i>	Table 4 – RTDC <i>%</i> Table 6 – RTDC <i>Loss of Crew</i>	Table 4 – <i>Loss of Crew Life %</i> Table 7 – <i>Loss of Crew Life, Loss of Crew</i>	Table 8 – <i>TI</i>
Score	3	3	3	2	3	3

Comments and limitations:

1. **General comments.** This CLIFF characterizes abdominal hernias with emphasis on inguinal, femoral and incisional hernias. The spectrum of symptoms can range from a symptomatic bulge in the groin to an incarcerated loop of bowel with excruciating pain. The latter would require urgent surgery. The condition can be diagnosed by history and physical exam as well as by a trained provider using ultrasound. Astronauts are screened for this condition prior to flight, and there has never been a reported case of a hernia developing during a space mission. Very mild hernias may go unnoticed. The best case is considered to be an asymptomatic or mildly symptomatic hernia not requiring surgery while the worst case is a hernia requiring either non-emergent surgery or emergent surgery due to complications.

2. **Incidence.** As there have been no reported cases of hernias during spaceflight, terrestrial data was used to calculate the incidence. A military survey that described the incidence of inguinal hernia and repair procedures informed the incidence distribution. There is a significant difference in risk between males and females; therefore, two separate incidence distributions were calculated. A limitation with this study is that it only included inguinal hernias which are much more common in

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men while femoral hernias, which are not considered in this study, are more common in females. The best case/worst case probabilities used data from two terrestrial studies which showed a 2-4% risk of abdominal wall hernias requiring surgical treatment (worst case), giving a best case probability of 96-98%. The clinical phase durations, RTDC and Loss of Crew Life probabilities are supported by terrestrial evidence, and I am in agreement with their calculation. The probability density curve that was derived appears to be a reasonable representation of the data presented.

3. Clinical phase data. I am in agreement with the clinical phase 1 duration entered in this CLIFF. This data was compiled by a team of expert clinicians, and I was involved in the discussions leading to the calculation of the clinical phase duration. CP2 was supported by terrestrial evidence.

4. Task impairment. The analysis was performed and reviewed by a separate team of expert clinicians. I am aware of the methods that were used but did not directly participate in the discussions.

5. Dependence on mission phase or duration of mission. This medical condition is not dependent on mission phase but are more likely to develop or to be symptomatic during periods of high workload, such as scheduled exercise or EVA.

6. Limitations

- Terrestrial outcomes for abdominal wall hernias are difficult to apply to the spaceflight environment since surgical treatment is unlikely to be available.
- It is uncertain if abdominal wall hernias would present differently or have different outcomes in microgravity and partial gravity environments than terrestrially.
- A limitation with the study used to calculate incidence was that it only included inguinal hernias which are much more common in men while femoral hernias, which are not considered in this study, are more common in females. However, inguinal hernias represent most hernias and are fairly representative of incidence overall.

Reviewed by:

David C. Hilmers