

Finger Dislocation CLIFF Peer Review

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

Score: 2

Grading Scale:

4 - *Confident*

3 - *Somewhat confident*

2 – *Neutral*

1 – *Somewhat unconfident*

0 – *Not confident*

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

Comments and limitations:

1. **General comments.** Dislocation of a joint occurs when traumatic forces cause complete loss of continuity between the two articulating surfaces of the joint. Anecdotal information exists for one possible finger dislocation during Skylab but is not included in the official Skylab mission log. The applicability of terrestrial literature to spaceflight incidence is questionable since the same forces which are present in unit gravity are not at work in microgravity.

2. **Incidence.** The calculated mean incidence is low (0.01676) and is based on a single, poorly documented finger dislocation during a Skylab mission. However, since this data is from spaceflight, it was felt to be the most informative. The calculated incidence implies that it will take 60 person-years before we might expect another event in spaceflight, which seems to be realistic. Assuming that there are no new dislocations, the incidence will continue to decline as the person-years in space increases; therefore, this value should be updated periodically. Of note, the calculated mean incidence from the spaceflight data is about 100 times that from terrestrial studies. It would be expected that the incidence would be higher in unit gravity, given the forces required to cause a

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dislocation. The probability density curve that was derived appears to be a reasonable representation of the data presented. The variance of the distribution is quite large, which is appropriate given the data that was used.

The RTDC probability for worst case was estimated to be zero. This was based on previous clinical team opinion, and no references were cited. However, the worst case is defined to require surgical intervention to reduce the dislocation. Since this capability will not exist on-board, it would seem that the RTDC probability should be equal to the worst case probability of 8%.

The surrogate for worst case was a terrestrial study that showed that 8% of reductions required general anesthesia. This seems like a reasonable assumption given that general anesthesia is usually associated with a surgical procedure. It might be an underestimation since some reductions may be done in the operating room with regional anesthesia.

The best case/worst case probabilities, clinical phase durations, and Loss of crew life probabilities are supported by terrestrial evidence. The treated best case and untreated best case CP2 treatment durations were made equal for lack of better data. The same is true for treated worst case and untreated worst case CP2 durations.

3. Clinical phase 1 data. I am in agreement with the clinical phase durations 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 durations.

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 would be more likely to occur during partial gravity operations or during an EVA. Cabin operations in microgravity would be less likely to lead to the forces and torques that would result in a dislocation.

6. Limitations

- The mean incidence was based on one, poorly documented event during spaceflight. The distribution does show a large variance, which is appropriate for the level of confidence that can be assigned to the mean incidence value. As more in-flight hours accumulate, the incidence value will decline, assuming that no new events occur.
- RTDC was assumed to be 0% by a previous Clinical and Science team; therefore, there were no RTDC literature searches performed. Since the need for surgery defines the worst case scenario, it would appear that the worst case estimate of 8% of dislocations would be a better number to estimate RTDC probability.
- The untreated worst-case scenario Loss of crew life was assumed to be 0% based on prior searches, but this was not substantiated by a literature search.
- The incidence most likely has some mission phase dependence, depending on the magnitude of gravitational forces and whether an EVA is being performed.

Reviewed by:

David C. Hilmers