

Evaluating ACLS algorithms for the International Space Station (ISS) – a paradigm revisited

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Overview

- History
- Background
- Current vs. Revised Algorithm
- Evaluation
- Findings
- Revised Algorithm: Short & Long Versions
- Conclusion – How the choice was made
- Challenges with implementation

History

- Emergency medical capabilities aboard the International Space Station (ISS) were developed in the late 1990's to help astronaut crew medical officers (CMOs) resuscitate a crewmember.
- Two ISS crewmembers are designated as CMOs for each mission and are trained in emergency procedures including Advanced Cardiac Life Support (ACLS).
- ISS CMOs are typically not physicians and ISS crews rarely have an on-board physician.



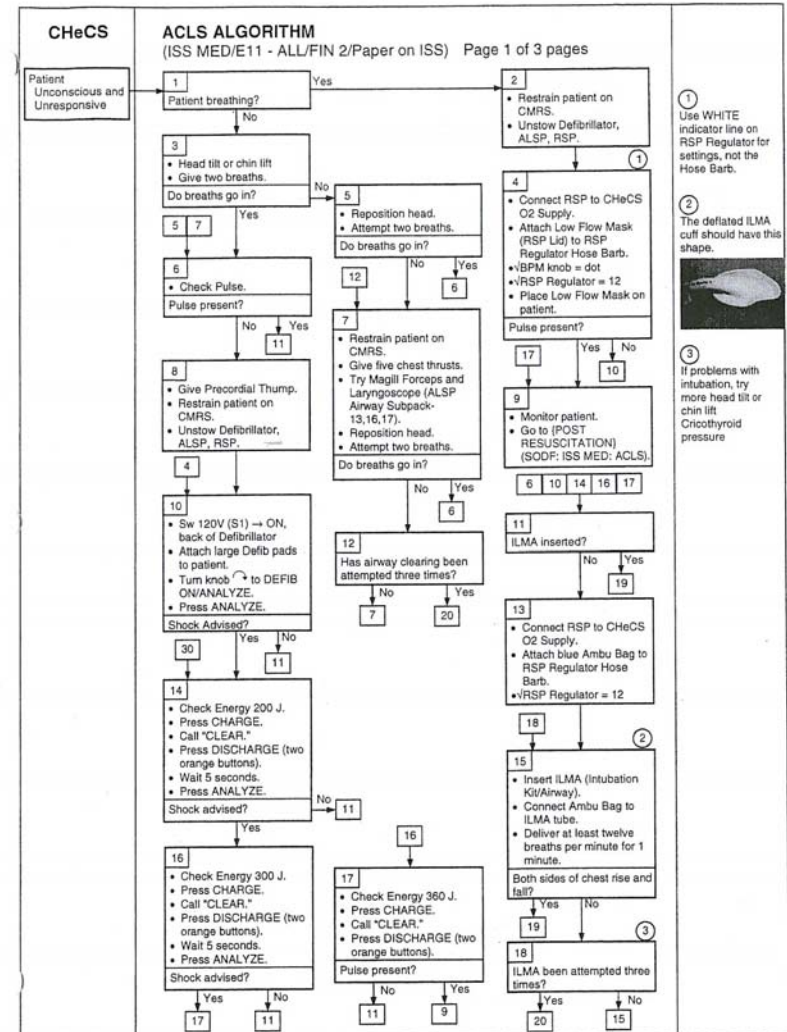
Background

- The ISS may have communication gaps of up to 45 minutes during each orbit and therefore it is imperative to have medical protocols, including an effective ACLS algorithm, that can be reliably autonomously executed during flight.
- The aim of this project was to compare the effectiveness of the current ACLS algorithm with an improved algorithm having a new navigation format.



Current ACLS Algorithm

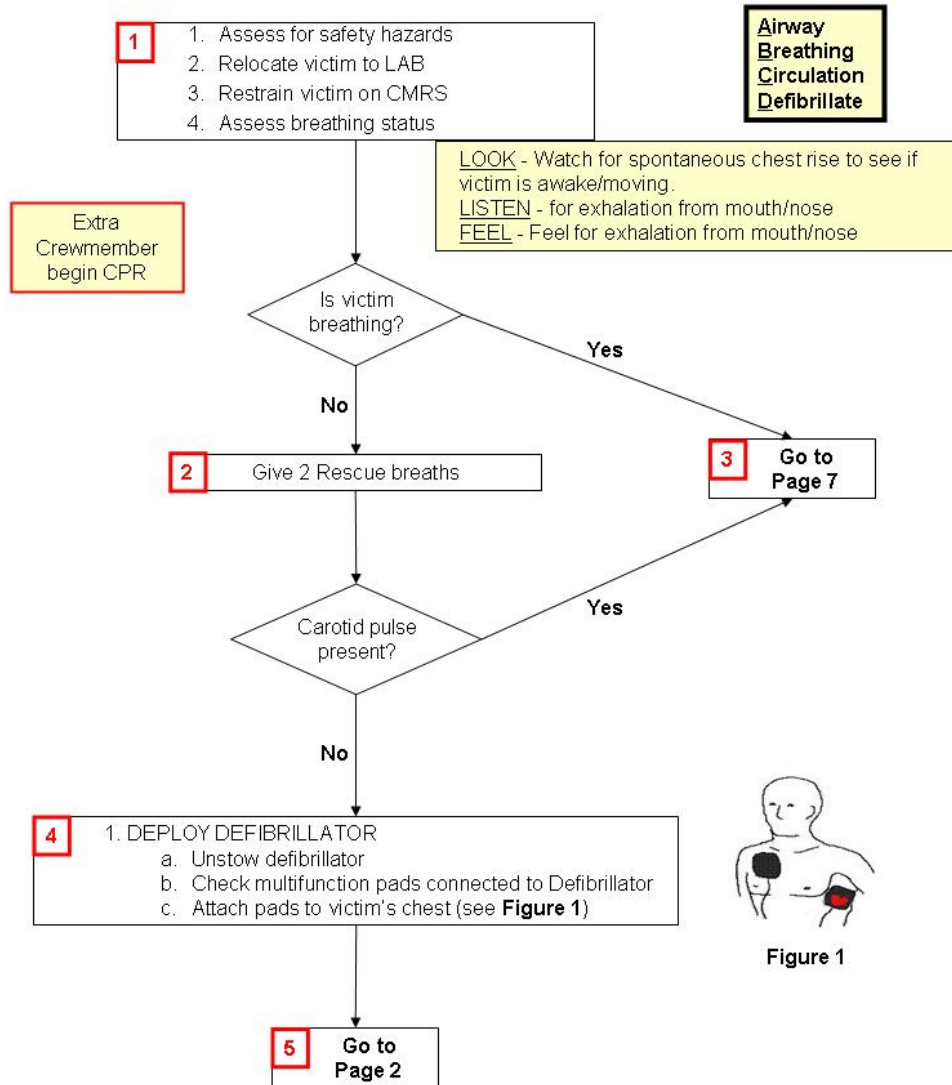
- Originally adapted to the ISS Malfunction ('Mal') format
- Latest revision was 10 Aug 06
- **3 pages in length**



Revised ACLS Algorithm

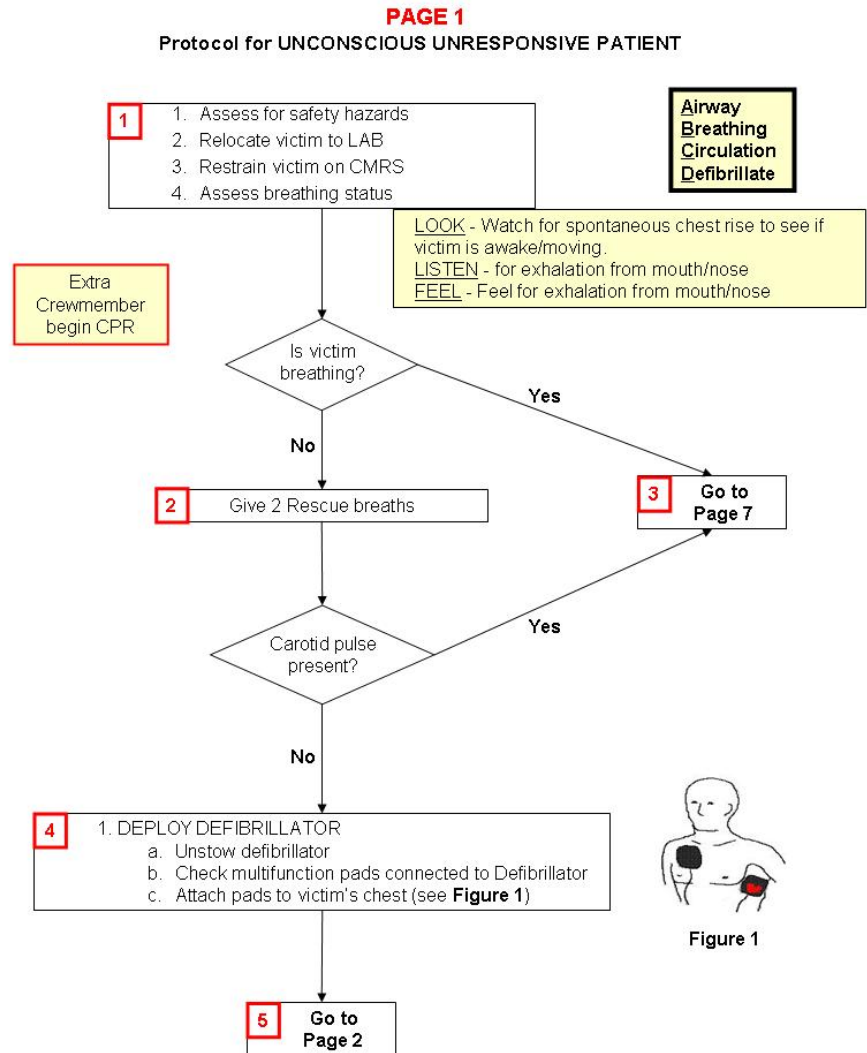
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Protocol for UNCONSCIOUS UNRESPONSIVE PATIENT



Revised ACLS Algorithm

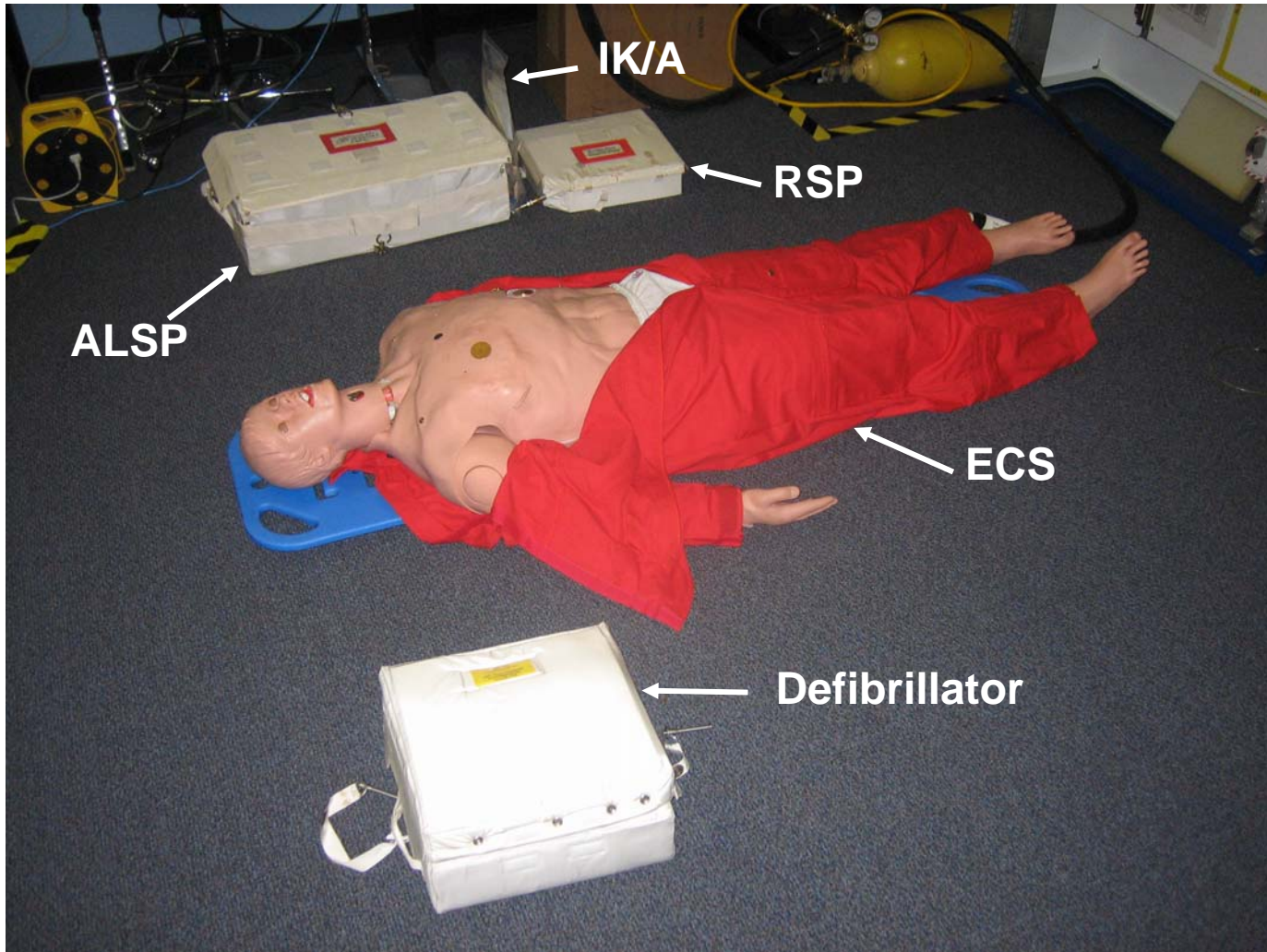
- Format adopted from ACLS Training Materials produced by the American Heart Association (AHA)
- Generated in Fall 2006 by representatives from the NASA-JSC Flight Surgeon Office and Wyle Laboratories' Medical Simulation Laboratory Group (MSLWG).
- **9 pages in length**



Evaluation Method

- Participants (CMO Analogs; n=8) were given a prebrief detailing expectations of the study (“think out loud”).
- Participants were then given the scenarios and used either the current and revised ACLS algorithms to mitigate the medical issue presented on the Emergency Care Simulator.
- The participants used ISS medical equipment as directed by the algorithms.
- All verbal communication and actions by the participants as well as investigator observations were recorded (audio, video, written questionnaire) during each scenario for subsequent analysis.

Configuration of Equipment



Study Findings

- **7 of 8** participants indicated their preference for using the Revised version of the ACLS Algorithm
- The content within the Revised ACLS Algorithm received higher scores from participants in regards to being
 - easier to comprehend,
 - having useful pictures,
 - being easier to navigate
 - having a more intuitive format.
- Only negative finding for the revised was the length (9 pages)

Revised Format - 2 Versions

- **LONG** - 9 Pages
 - Evaluated by MSLWG
 - Follows full ACLS guidelines from AHA
- **SHORT** - 6 Pages
 - Developed from the **LONG** ACLS Algorithm
 - Focuses on defibrillation and CPR
 - Moves to back of algorithm as an appendix
 - drug administration
 - ILMA Troubleshooting
 - Has Respiratory Assessment being directed by Flight Surgeon

Conclusion

- **Discussion with Flight Medicine revolved around choice of long v short version:**
 - **Are AHA guidelines being formally followed**
 - **Skill level of the crew in delivering medication vis IV**
 - **Effectiveness of ET Meds in space**
 - **Early defibrillation benefits**
 - **What changes would later need to be made to the algorithm with flying an AED as primary intervention instead of the current Defib.**
- **Vote in favor of the Short Algorithm**
- **Next phase implementation**

Process Issues -Why this isn't a simple change

- FS agreement and consensus is necessary for the change to occur
- Formal Change Request process is in place that must be followed
- Several NASA Boards approval required before inclusion of new algorithm in the ISS Medical Checklist
- New Algorithm format will require waivers from authorities such as SODF (Mal Format owners)
- Labor intensive change in time of limited resources
- Russian translation required
- Training timeline for crewmembers is 18 months pre – flight
- Update will need to be manifested for flight (hard copy and software update)

**Back up
slides**

Overall Survey Results

Very Negative Reaction 1-2, Neutral 3-5, Very Positive Reaction 6-7

Questions	Current	Revised
Procedure content is concise	5.89	5.50
Procedure content is easy to understand	5.33	5.83
Pictures provided useful information	3.00	5.33
Format is easy to navigate	3.73	5.00
Format is intuitive	3.82	5.33
Understanding the content provided in the algorithm	5.44	6.17
Navigation through the ACLS algorithm	4.67	5.83
Understanding the instructions in the algorithm	5.56	6.00
Navigation through the ACLS algorithm	4.75	5.50

Algorithm Content Survey

Completely Disagree 1-2, Neutral 3-5, Completely Agree 6-7

Questions	Current	Revised
Procedure content is concise	5.89	5.50
Procedure content is easy to understand	5.33	5.83
Pictures provided useful information	3.00	5.33
Format is easy to navigate	3.73	5.00
Format is intuitive	3.82	5.33

Difficulty Survey

Very Difficult 1-2, Neutral 3-5, Not Difficult at All 6-7

Questions	Current	Revised
Understanding the content provided in the algorithm	5.44	6.17
Navigation through the ACLS algorithm	4.67	5.83

Frustration Survey

Completely Frustrated 1-2, Neutral 3-5, Not Frustrated at All 6-7

Questions	Current	Revised
Understanding the instructions in the algorithm	5.56	6.00
Navigation through the ACLS algorithm	4.75	5.50

Clarity Errors

Current	Revised
18	10

Type of Clarity Errors: Absence of Cue, Terminology, Congruence