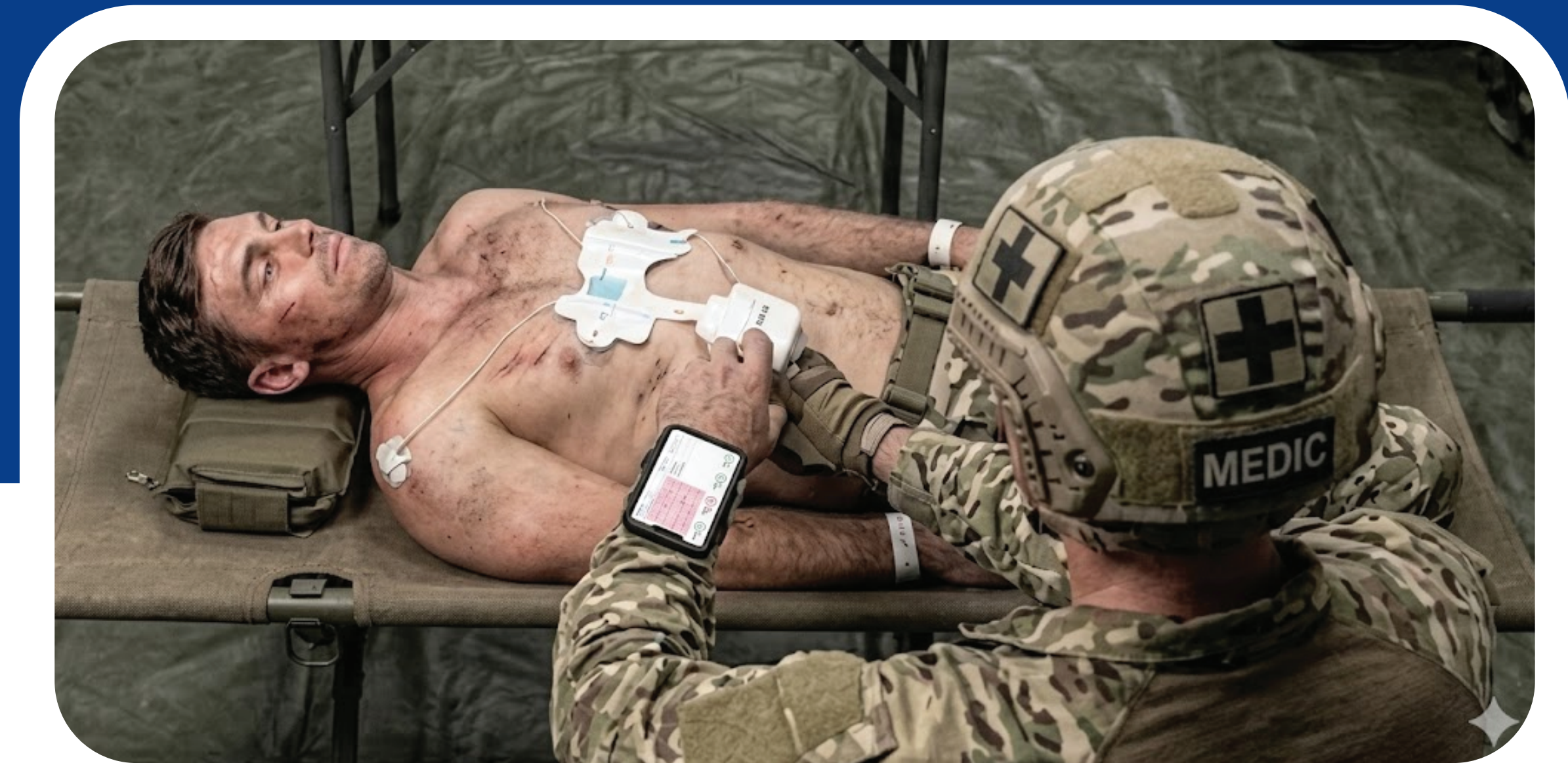


Wearable 12-lead ECG with Advanced Algorithms for Tactical Triage and Monitoring in Prolonged Casualty Care



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Abstract

PCA 500® is FDA cleared 12-lead ECG for professional and personal use. It is compact, wireless, mobile, connected and wearable. In this project, we aim to develop, test and validate a wearable 12-lead ECG for immediate triage and monitoring in casualty care. PCA 500® will be connected to a mobile phone by Bluetooth to record and analyze ECG. We will integrate with the BATDOK® platform. The wearable system will be capable of programed recording for periodic examination and risk checking. AI algorithms will be used to detect arrhythmias, STEMI, cardiac dysfunction, pulmonary embolism and risk for death.

Introduction

Providing prolonged care in resource-constrained, communication-limited settings is challenging. We propose PCA 500® as a wearable point-of-care 12-lead ECG powered by advanced algorithms for triage and prolonged care monitoring.

Capability Description

The technology addresses two capabilities:

1. Triage of combat casualties for quick decision on medical care and evacuation;
2. Monitoring of combat casualties in prolonged care by automated ECG algorithms.

Methods/Technical Approach

PCA 500® is medical standard 12-lead ECG cleared by the FDA for professional and laypeople use. Based on this platform, improvements will be made and integration with BATDOK® platform will be completed for military use, including the following tasks:

- Operating without internet connectivity: Each PCA 500® device will be paired by Bluetooth with a smartphone to run edge AI algorithms on device.
- Wearability: For use in the less controlled environment and wearing for a longer period of time, the sensor will be further designed and tested, and the battery life will be extended to support up to 24 hr of continuous monitoring.
- Advanced monitoring algorithms powered by artificial intelligence—We deploy diagnostic and predictive ECG algorithms by AI for the following 4 conditions: cardiac ischemia (STEMI), cardiac dysfunction (reduced ejection fraction), pulmonary embolism, and risk for mortality.

Results

We developed the system and sub-system architecture of the recorder for use in the field. The Android app for Bluetooth connection and prolonged monitoring was developed. Serial comparison algorithms for current and previous ECGs were developed and successfully deployed to the app. AI-based algorithms for STEMI, low EF, pulmonary embolism and mortality risk are under development and testing.

Applicability to Medical Roles of Care

PCA 500® will check the current cardiac status (e.g. arrhythmia, ischemia, electrolyte imbalance), then the AI algorithms can monitor for STEMI, cardiac dysfunction, pulmonary embolism, and importantly, the risks for mortality, important information for decision making on prioritizing medical evacuation and resource allocation.

Impact to the Warfighters

In combat-related injury, it is important to triage of the patient's current conditions and identify those at risk. A wearable, point-of-care ECG device for diagnostics can be used for triage of patients at increased risks for cardiac complications. Automated periodic monitoring of risks for complications, such as STEMI, cardiac dysfunction and mortality, can reduce resource use and save lives.

Developmental Status

PCA 500® is FDA cleared and has been used by thousands of professionals and patients. We are developing the system for triage and cardiac monitoring for military use. It will require further testing and validation.

Conclusion

- PCA 500® can be integrated with BATDOK® platform or other Android-based mobile devices
- Professional grade 12-lead ECG can be obtained in <2 min
- 12-lead ECG can be used for triage of patients at risk for cardiac complications
- PCA 500® can be used as wearable monitor and periodic assessment device for risk of complications.

