

EDMAID: Increased Heart Attack Diagnostic Accuracy for Emergency Departments

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Abstract— We present a technology that improves accuracy of diagnosing acute myocardial infarction based on ECG signals in the Emergency Department setting. It achieves such improvements without altering the standard of care workflow or signal collection methodology.

Clinical Relevance— Presented tool may contribute to a reduction in the delay to treatment for patients with acute myocardial infarction as well as in reducing the rate of missed acute myocardial infarction.

I. INTRODUCTION

Timely and accurate diagnosis of Acute Myocardial Infarctions (AMIs) in the Emergency Department (ED) is of crucial importance in improving clinical outcomes. Chest pain is the second most common reason for ED visits, and time to treatment is so significant that standard of care guidelines recommend that all chest pain patients undergo an ECG within 10 minutes of arriving at the ED. However, studies have shown that non-cardiologist physicians have a very wide range accuracy of 36% to 96% in detecting ECG abnormalities [1]. Moreover, the inter- and intra-observer variability of physicians' interpretation of ECGs contributes to further uncertainty in placing the patient on a correct care path. Numerous studies have estimated that from 1% to 8% of patients with AMIs are not diagnosed correctly in EDs and are inadvertently sent home [2]. In this study, EDMAID provided a highly accurate, interactive, easy-to-use software solution for physicians to improve the interpretation of ECG signals in diagnosing AMI.

II. METHODS

EDMAID tool was developed for use in the ED environment when a baseline ECG for a chest pain patient is available in the Electronic Medical Records (EMR). This web-based application is secured and HIPAA compliant as it deals with personal medical records. It resides in the cloud and comprises three basic blocks (Fig. 1). It receives only two input files: baseline (non-symptomatic) and ED chest pain (symptomatic) ECG file. Hospital IT system hosts a thin client that is used by a physician to view both ECG signals, display calculated fiducial points (Q, R and J) on both ECG signals and allow physicians to move them if they were incorrectly placed by

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EDMAID. Similar signal visualization software was previously described in [3].

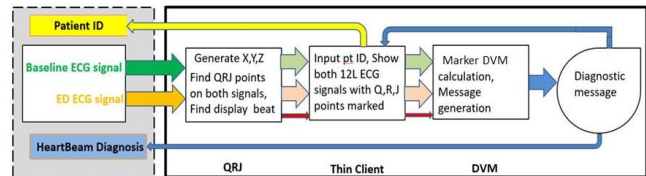


Figure 1. EDMAID block diagram: 1) QRJ module (converts standard 12-lead baseline ECG file to the Frank 3-lead (X,Y,Z) vector projections representation and finds Q,R and J points), 2) Thin Client, 3) DVM module.

The last module calculates the AMI Differential Vector Marker (DVM) between chest pain (ED) and baseline (B) recordings in the ST interval (from J+10ms till J+60ms) of the cardiac cycle [3]. Based on DVM value a diagnostic message is generated and fed back to the thin client for the benefit of ED physicians.

III. RESULTS

Study enrolled 66 patients whose arteries were occluded during a Percutaneous Coronary Intervention (PCI) had cardiac signals collected by standard 12-lead ECG. A total of 184 signal files (118 occlusions plus 66 negative controls) were analyzed by EDMAID software and a panel of three expert cardiologists. DVM had significantly higher performances in identifying AMIs: *Accuracy*: 94.02% vs. 72.83%, *Sensitivity*: 95.76% vs. 79.66%, and *Specificity*: 90.91% vs. 60.61%.

IV. DISCUSSION & CONCLUSION

In this study, EDMAID presented with superior ability to detect AMI when compared with the accuracy of a panel of cardiologists. Our results show potential for the EDMAID software to be utilized as a diagnostic suggestion tool in ED settings.

REFERENCES

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