SLOVENSKO ZDRUŽENJE
ZA URGENTNO MEDICINO
SLOVENIAN SOCIETY
FOR EMERGENCY MEDICINE

23. mednarodni simpozij o urgentni medicini

INTERNATIONAL SYMPOSIUM ON EMERGENCY MEDICINE

URGENTNA MEDICINA
EMERGENCY MEDICINE

IZBRANA POGLAVJA / SELECTED TOPICS

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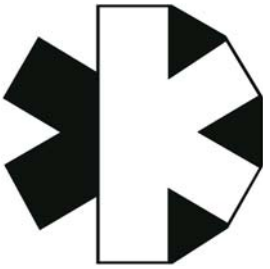

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SLOVENIAN SOCIETY FOR EMERGENCY MEDICINE

URGENTNA MEDICINA
IZBRANA POGLAVJA

2016

EMERGENCY MEDICINE
SELECTED TOPICS

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Rajko Vajd
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POSTERJI
POSTERS

UPORABA NOVE TEHNOLOGIJE ZA ZMANJŠANJE SMRTNIH PRIMEROV VOJAKOV, RANJENIH V BOJU

THE USE OF NEW TECHNOLOGY TO LESSEN THE DEATH-RATE OF SOLDIERS INJURED IN COMBAT

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Abstract

On a battlefield wounded soldiers suffer comlex and severe injuries. First responder has a primary role in these situations, providing medical treatment to wounded soldiers, helping them to stay alive until medics can treat them. Recent technological development can help first responder and medics to triage wounded and improve the efficiency and effectiveness of these emergency activities.

In this paper we are presenting a novel approach, using a biosensor for measuring soldiers' vital parameters data, and a mobile application for gathering, organizing and visualizing this data. We believe that this solution will help saving more lives on a battlefield.

INTRODUCTION

In a battlefield environment, medics are expected to treat severe and complex injuries with limited supplies in dusty and dirty environments while also risking their lives. Soldiers can gain various and complex injuries that can cause sudden death or life-long disability. Usually, wounded soldiers require demanding care which can only be provided in a hospital. However, when soldiers are wounded in combat, the most immediate medical care available generally is given by first responder.

The primary role of first responder is providing medical treatment to wounded soldiers, thus helping them to stay alive until medics can treat them. How does the first responder prioritize injuries if there are multiple injured soldiers? How the first responder prioritizes these injuries and how does he treat injuries when different types of treatment pose various other risks?

Recent technological development can help medics to triage injured patients on the battlefield, thus reducing the mortality rate.

New information and communication technologies may allow faster flow of information between soldiers and medics. Mobile devices (smart phones or tablets) that provide a user-friendly information environment can be used as a new communication channels, even in a battlefield environment. The ability of first responders to communicate with voice and/or data with other responsible persons and medics during the combat is a key element in providing life-saving medical care, and a secure evacuation of an injured soldiers. (Fig .1)

On the other hand, the development of various biosensors (fig. 2), for detecting, recording, and transmitting information regarding life process, can also be used on the battlefield. The important characteristics of these biosensors are their low-cost and small form factor. They are miniaturized, wearable, non-intrusive devices that can monitor vital signs of a patient/soldier.

Having in mind these technological advancements, we have decided to develop a system (SIARS - Smart I (eye) Advisory Rescue System) that will help saving more injured soldiers on a battlefield and lessen the death-rate.

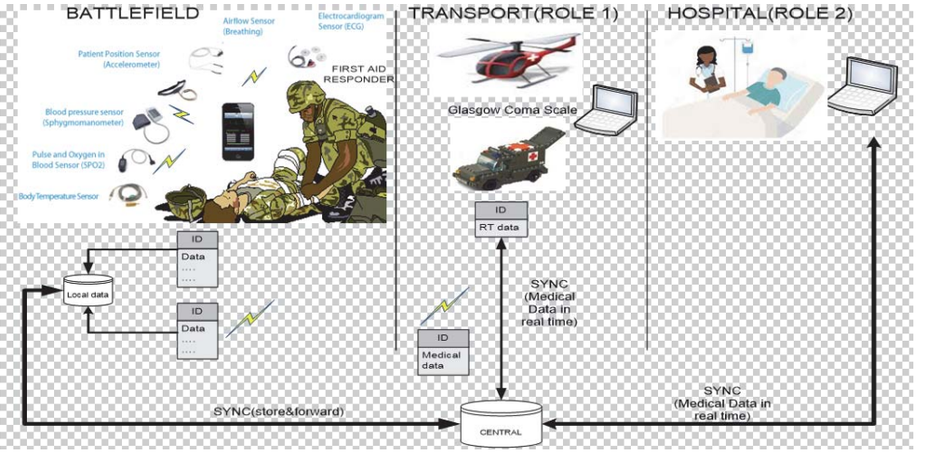

Fig 1. *Monitoring and transfering vital signs from the battlefield to Role 2.*

Fig. 2. *Biosensors*

The system include a mobile application, which will be used for gathering, organizing and visualizing the medical data of the injured patient/soldier. This data will be further transfer to the designated medical facility that will take medical care of the injured person. The users of this mobile application will be: first responder, team commander, and medics and medical staff (in transport team, Role1 and Role2).

For gathering the vital parameter data of the injured patient, a proprietary biosensor attach to the soldiers' body will be used. Vital signs like: ECG, respiratory rate, oxygen rate, temperature, and blood pressure will be measured with the help of this sensor.

TRIAGE AND MEDICAL CRITERIA

We incorporate in algorithm how to approach to the wounded ATLS protocol and shock classification (fig. 3) which is the most worldwide accepted among military and civilian medical professionals.

Fig 3. *ATLS shock classification.*

The European guideline on management of major bleeding and coagulopathy following trauma: Fourth edition

Rossaint R, Bouillon B, Cerny V, Coats TJ, Duranteau J, Fernández-Mondéjar E, Filipescu D, Hunt BJ, Komadina R, Nardi G, Neugebauer EAM, Ozier Y, Riddez L, Schultz A, Vincent J-L, Spahn DR

Table 2. American College of Surgeons Advanced Trauma Life Support (ATLS) classification of blood loss* based on initial patient presentation. Table reprinted with permission from the American College of Surgeons [84].

	Class I	Class II	Class III	Class IV
Blood loss (ml)	Up to 750	750-1500	1500-2000	>2000
Blood loss (% blood volume)	Up to 15%	15%-30%	30%-40%	>40%
Pulse rate (bpm)	<100	100-120	120-140	>140
Systolic blood pressure	Normal	Normal	Decreased	Decreased
Pulse pressure (mmHg)	Normal or increased	Decreased	Decreased	Decreased
Respiratory rate	14-20	20-30	30-40	>35
Urine output (ml/h)	>30	20-30	5-15	Negligible
CNS / mental status	Slightly anxious	Mildly anxious	Anxious, confused	Confused, lethargic
Initial fluid replacement	Crystalloid	Crystalloid	Crystalloid and blood	Crystalloid and blood

*for a 70 kg man

Major bleeding and shock status are the most challenging concerning trauma in military and civilian environment. Understanding physiology of bleeding and coagulopathy in trauma, understanding response of body mechanisms on major bleeding and vital parameters, proper management and guiding principles to local situation can lead to better survival rate.

For the triage system we use the SORT system with where vital parameters are valued numerically. and categorize the wounded into three categories: T1- immediate, T2 – urgent and T3 – postponed.

With technical support via wireless biosensors we can record dynamic response of wounded and prioritize the most unstable patients.

MOBILE APPLICATION

During the battle, it is crucial to know if some soldier is wounded and what is the level of his injury. This information is essential for the first responder, because it's his responsibility to give a medical care (first aid) to the wounded soldiers. Using the mobile application, he can get alert about injured soldier, and a level of injury (which is calculated by triage priority module) (Fig.4). This will help him to prioritize the wounded soldier, in order to know where to go first.

Also vital parameters data for the injured soldier can be visualized, in order to get a better picture of soldier's health condition. (Fig.6). Data can be presented with numbers or graph.

Knowing the level of injury (according to simple triage process) is initially important for the first responder, but for the medics it is also very important to calculate the level of injury, using the Glasgow Coma Score (GCS), and Triage Sort Score. So, the mobile application allows the first responder to input the necessary data (to check the necessary fields about: eye opening, verbal and motor response) in order to calculate the level of injury (Fig.7).

First responder can also mark the parts of the body where the injury is (Fig. 8), and can insert medications that he gave to the wounded soldier.

All this information is sent to the database, where other roles can monitor the state of the injured individual. The medics (in transport team, in Role1 or in Role2) can also use these data, in order to prepare to intervene in short time.

CONCLUSION

Recent technological development can help medics to improve the efficiency and effectiveness of incident response and emergency management activities. This is especially important in a battlefield

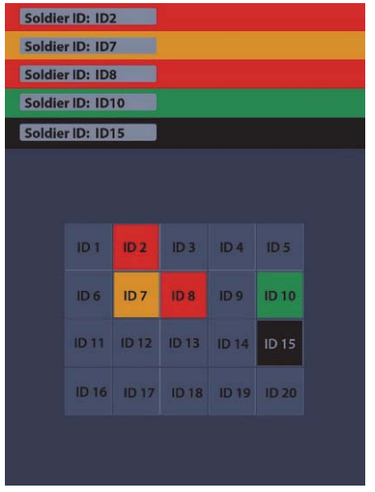

Fig. 5 *Alerting about injured soldiers*

Fig. 6 *Vital parameters data presentation*

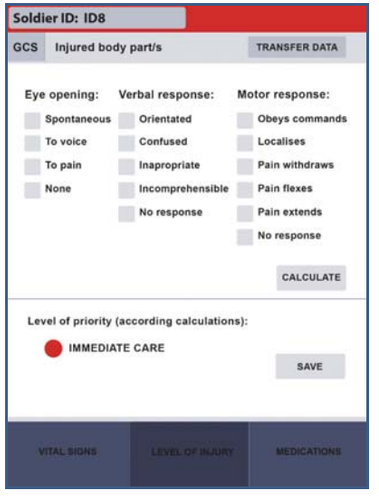

Fig. 7. *Calculating the level of injury according injury is*

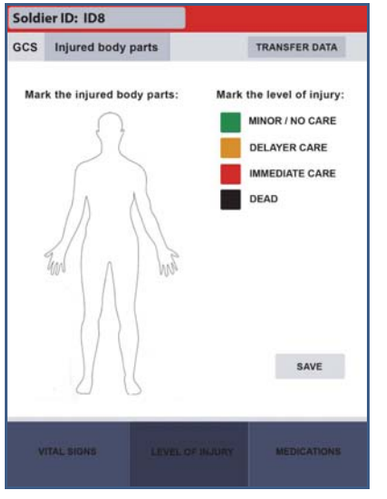

Fig. 8. *Marking the parts of the body where the to GCS and TSS*

environment, where new technological achievement can be used to help wounded soldiers to get the appropriate medical care on time.

In this paper we have presented a novel approach, using a biosensor for measuring soldiers' vital parameters data, and a mobile application for gathering, organizing and visualizing this data. We believe that this solution can help to save more lives of soldiers wounded in combat.

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