Telemedicine - Opportunity for Improving Survival Likelihood during Emergency Medical Services

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Abstract

Efficient information exchange is the fundament on which successful pre-hospital patient care should be based, especially when emergency medical services are being invoked. The quickly arrive at the scene, clear and reliable information at the right time are often crucial for the patient survival. All aspects of pre-hospital care require constant and efficient communications. In addition to using routine radio communications, the EMS team must organize and present patient information through spoken communication and in written reports. The voice transmission over radio channels can be limited because of weak signals or language problems. It need human operators.

The aim of our contribution is to present a prototype for data exchange over radio network. Our prototype has shown that using it we can simply, promptly, and exactly transfer the information over long distances.

Key words: telemedicine, emergency medical system, radio communication

1: Introduction

Efficient information exchange is the fundament on which successful pre-hospital patient care should be based, especially when emergency medical services are being invoked. The quickly arrive at the scene, clear and reliable information at the right time are often crucial for the patient survival. Recognising that, a new field called Telemedicine has been established during recent years. In general Telemedicine is concerned with »performing health care over long distances« using the enormous possibilities of the information and communication technology.

Currently several telemedical applications related to emergency medical services indicated the problem of collecting timely and precise information in the treatment of life endangered patients but also suggested the possible use of information and telecommunication technology in solving such problems.
For many years the so called »long distance problem« has been successfully resolved with the employment of radio or telephone communications. In that manner important information about patient status can be send to the hospital long before the patient arrives and the patient treatment time in the emergency unit can be significantly reduced [5]. But due to bad weather conditions, language problems (the messages can not be understood) or weak signal, radio and telephone based communications can become ineffective [6].

The enormous advancement in the information and communication technology introduces many new possibilities in health care applications found in recent reports [8,9] like the use of ISDN channels for transmission of multimedia medical documentation. In that way the patient status can be decided long before the patient actually arrives – the valuable time is gained. In addition the introduction of radio station into the computer system enables the computerised control of emergency vehicles. Research has shown that such system result in the decline of response times increasing the quality of health care [4].

From above it is clear that the use of information technology can be especially beneficial in the emergency medicine, where time is of special value. A typical EMS response begins with occurrence of an accident or illness. Then, someone must detect the emergency and summon EMS. Upon receipt of essential information, the dispatcher sends the appropriate EMS unit to the scene of the emergency. The patient will then be transported to the hospital and care of the patient is transferred to the hospital staff. Following delivery of the patient, the medical record must be completed. Then, all equipment must be prepared for the next response. Communication play a significant role through.

All aspects of pre-hospital care require constant, efficient communications [1,2,3]. In addition to using routine radio communications, the EMS team must organize and present patient information through spoken communication and in written reports. The voice transmission over radio channels can be limited because of weak signals or language problems. It need the human operators. In some cases the transmissions can be longer (the messages can not be understood).

The aim of our contribution is to present the possible use of information technology in improving communications quality and efficiency. We will introduce the prototype of electronic data interchange over radio network between emergency vehicles and emergency centre.

2: The prototype design

To test our ideas we developed a prototype for data exchange over radio network in the Emergency Medical Service and performed a pre - analysis of information technology in the manner to improve communications between the dispatcher, the team on the field, and the team in the hospital.

The prototype enables precise and secure data exchange based on both voice and digital channels its main advantages are:

- Selective messages.
- Global messages for the group.
- Possible access to the central data base.
- Fast, short burst messages.
- Automatic intelligent channel access.
- Automatic repetition until exact data is received.
- More users and more traffic are possible on the radio channels.
- Automatic system (no human operator needed)
- Direct host access (no human operator needed).

In such manner our prototype enables:

- data exchange between an emergency vehicle and emergency centre (i.e. sending data about basic medical data and expected arrival time),
- prompt and automatic access of victim’s risk,
- sending the patient’s health status data to the emergency computer centre, enabling the centre to alert the proper medical experts and prepare medical instrumentation,
- teleconsulting the emergency vehicle stuff.

The workstation

The emergency vehicle workstation consists of a mini computer and a radio station. We used the radio station VRC2200 (made by Electra – Italy) which in addition to standard voice communication enables also computer communication and control:

- turning on the station,
- selecting the communication channel,
- selecting the code,
- tone based calling,
- securing the transmission,
- setting the volume of voice signal,
- automatic data transmission.

Above solution also supports the computerised control of emergency vehicle positions. The driver sends its position by a simple »click« on the computer. Alternatively a GPS (General Positioning System) can be used.

3: Demonstration project results

The prototype was presented to the heads of Emergency service, heads of Clinical Centre and the leader of the national project. The emergency vehicle was equipped with the radio station connected with the mobile personal computer. The radio station in the dispatcher centre was coupled with the personal computer connected to the central computer system of the hospital (see Figure 1). In such manner we effectively demonstrated the voice and data transfer over radio network.
3.1: The procedure

The first link in EMS communications is the notification of the EMS system. Notification occurs between a party requesting help and the EMS dispatcher. The dispatcher must decide which vehicles to dispatch. To use EMS resources most efficiently, the dispatcher must know the location of all vehicles and their capabilities. An appropriate vehicle is selected and a digital identification is send over radio channels. Computer controlled radio station situated in the vehicle receives the call and acknowledged it.

After that the dispatcher sends the basic data related to the emergency event. In the case that the personal ID is known the computer searches the central database in the manner to find the patient history (diabetes, cardiac diseases, infectious diseases, allergy on some medicaments, etc) and merge the relevant data to the basic report. The whole data transfer is computer controlled (without the human intervention). In the case of bad transfer the software tries to repeat the message and if it does not succeed in five attempts the software changes the channel.

When the vehicle receives the data it drives to the place of the emergency event and changes its status to “bussy”. During the transfer the emergency team in the vehicle reports to the hospital about the patient status and needed interventions using the computer and the protocol described above.

After the patient is delivered to the hospital all the data from the computer in the vehicle is downloaded to the hospital computer and the vehicle status is changed to “free”.

Figure 1: Communications system
3.2: Gains

Following gains have been achieved using the prototype (i.e. data transmission):

- the more efficient and secure data exchange between the emergency vehicle and emergency centre, since voice transmission has following weaknesses:
  - the voice transmission usually contains also some not so important information,
  - for the security reasons the voice message has to be confirmed by repetition,
- the medical stuff in the vehicle can be concentrated only on medical activities because all the communication is performed automatically,
- the important information about the victim is provided automatically,
- data can be stored in the mobile notepad computer and transmitted to host computer, reducing data entry time, paper storage needs and printing costs.

4: Discussion and evaluation

Data exchange over the radio network is one of the viable possibilities offered by the information technology. Our prototype has shown that using it we can simply, promptly, and exactly transfer the information over long distances. However an extended study is needed to show the influence of above data transfer to the overall quality of emergency health care and the time of pre-hospital care. In addition we have to solve some problems, like:

- Relations between neighbouring countries (noise on radio channels due to various reasons).
- Resources needed to develop a “repetitor” network.

Once when the prototype will become fully operational, and the suggested solution implemented it is expected that the quality of emergency health treatment will be significantly raised, while prompt and accurate information is crucial for the efficiency of patient care, effective decision making or it can even save patients life.

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