

Telematic Systems in Emergency Medical Services, Applied in Treatment of Acute Coronary Syndrome of STEMI Type

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Abstract. Teletransmission systems play an ever-growing role in the National Emergency Medical Services System. In Poland, commencing from the year 2006, this technology has become the basis for a wide diagnosis and treatment of Acute Coronary Syndrome (ACS) of STEMI type. This paper describes the application of teletransmission systems based on the example of Bielsko-Biala Emergency Services. Various aspects ensuing from functioning of the system in the field of Emergency Medical Services were subjected to analysis. Operating time and healthcare facilities to which patients with acute coronary syndrome were subsequently transported were analysed. The effect of time factor on the prognosis for patients diagnosed with STEMI was assessed. The conclusions drawn confirm usefulness of teletransmission systems in Emergency Medical Services.

Keywords: Emergency Medical Services, Acute Coronary Syndrome, Myocardial Infarction, Telemedicine, Teletransmission.

1 Introduction

The history of application of telematic systems used in healthcare goes back to the year 1985 when in the United States the first medical data transmission in the form of CT scans sent to remote specialised healthcare centres [1] was used. In the Polish healthcare history, teletransmission was used for the first time in 2005 in pilot programmes. In 2006 there were implemented systems of early treatment of Acute Coronary Syndrome (ACS) of STEMI type, taking advantage of telematic methods of diagnosis.

1.1 System Changes in Emergency Medical Services with Reference to Telematic Systems Application

The system of National Emergency Medical Services in Poland has been undergoing dynamic changes and steady development. The system changes affect a number of

elements, starting from medical personnel and ending with application of more and more technologically advanced medical procedures. One of the main changes in the process of reorganization of the National Emergency Medical Services involves introduction of a basic and a specialised unit. The basic unit, in pursuance of the Act on the National Emergency Medical Services of September 8, 2006, comprises at least two persons, meeting the system requirements, to the exclusion of a physician. A specialised unit must include a specialised physician of the specialty specified under the Act referred to above [2]. The range of activities pertaining to a basic unit is extremely broad, while at the same time their possibility to make decisions, such as giving a diagnoses or referring a patient to the specialised unit without a prior consultation is relatively restricted. Under such circumstances, teletransmission teletransmission systems used by EMS basic units take on a whole new dimension.

1.2 Components of Teletransmission System for Emergency Medical Services

While describing possibilities offered by teletransmission, the components without which the application of this method would not be possible should be mentioned. In order to transmit data, a transmitter station is necessary - in this case a defibrillator or a cardiac monitor located at the specialised unit [1]. Proper teletransmission requires appropriate application of all indispensable elements. It is necessary to carry out a heart activity monitoring procedure, set forth under the relevant standard, by analyzing a 12-lead ECG curve. Electrodes must be placed appropriately on the chest and ECG test must be properly performed. The above elements are vital for collecting and transmission of high quality ECG data records [3].

1.3 Teletransmission in Acute Coronary Syndrome

Teletransmission used by Emergency Medical Services finds a particular application in diagnosing the Acute Coronary Syndrome (ACS) in a patient.

The Acute Coronary Syndrome comprises unstable angina, non-ST-segment elevation myocardial infarction (NSTEMI) and ST-segment elevation myocardial infarction (STEMI) [4]. In Poland, approximately 140 thousand patients are hospitalized with ACS, out of which 50 thousand with the final diagnosis of ST-segment elevation myocardial infarction and about 30 thousand with non-ST-segment elevation myocardial infarction [5]. Heart diseases, with coronary heart disease in the lead, make up the shortlist of causes of hospitalization. According to GUS (Central Statistical Office) every ninth adult resident of Lublin, Łódź and Świętokrzyskie Provinces suffers from coronary disease [6]. While examining the condition of an ACS patient, a particular attention should be drawn to the likelihood of STEMI incidence. This type of ACS is characterized by the fact that a proper assessment of vital signs and an analysis of a 12-lead ECG are sufficient to make a full diagnosis.

The basis of treatment of myocardial infarction lies in reperfusion therapy, i.e. primary percutaneous coronary intervention (PCI). The time factor is of particular importance in proper treatment of a patient with ACS of STEMI type. According to the guidelines set forth by the European Society of Cardiology (ESC) of 2005, the

maximum length of time from the onset of myocardial infarction to admission to the hemodynamics laboratory to have PCI performed should not exceed 120 minutes [7]. While analyzing the condition of a patient with STEMI, one cannot underestimate the importance of teletransmission in shortening the time from the onset of myocardial infarction to admission to the hemodynamics ward.

2 Materials and Methodology

In order to carry out an analysis of teletransmission usefulness for the purpose of Emergency Medical Services, statistical data provided by Bielsko-Biała Emergency Services (BBES) were used. A retrospective analysis covered medical documentation (EMS Dispatch Cards) between the period from November 2011 and January 2012. Operating time from the moment of accepting the dispatch request until arrival at a medical treatment destination was subjected to analysis. The number of teletransmissions performed by particular EMS teams in relation to the number of patients transported to the hemodynamics ward at the American Heart of Poland in Bielsko-Biała (AHP) was also analysed. This analysis encompasses ambulance dispatch requests within the area of Bielsko-Biała district, responded to by the Emergency Medical Services of Bielsko-Biała Emergency Services (BBES). The whole fleet of BBES ambulances comprises six specialised EMS units and five basic EMS units owned by BBES, located across the whole district.



Fig. 1. Location of EMS units in Bielsko-Biała district in 2012

3 Results

On the basis of analysis of the results presented in table 1 it transpires that between November 2011 and January 2012 the number of STEMI ACS incidents accounted for the following number: November 2011- nineteen (27.53%), December 2011-ten

(14.49), January 2012-ten (14.49%), totalling thirty nine (56.52%) of all calls to cardiac conditions in the case of which a decision to perform a teletransmission was made. Other cases account for thirty calls (43.47%). It determines an approximate incidence rate of myocardial infarction, in the treatment of which the fastest possible transportation of a patient to an invasive cardiology ward is an absolute necessity.

Table 1. Calls to cardiac conditions, in the case of which decision to perform teletransmission was made

	Number of patients transported to AHP following teletransmission	Number of patients transported to another cardiology ward following teletransmission	Number of patients in the case of whom teletransmission was performed
November 2011	19 (27.53%)	12 (17.39%)	31(44.92%)
December 2011	10 (14.49%)	13 (18.84%)	23 (33.33%)
January 2012	10 (14.49%)	5 (7.24%)	15 (21.73%)
Total	39 (56.52%)	30 (43.47%)	69 (100%)

Table 2. The number of performed teletransmissions depending on the type of EMS unit

	Number of teletransmissions performed by specialised EMS units	Number of teletransmissions performed by basic EMS units	Total (%)
November 2011	14 (45.16%)	17 (54.83%)	31 (44.92%)
December 2011	10 (43.47%)	13 (56.52%)	23 (33.33%)
January 2012	5 (33.3%)	10 (66.6%)	15 (21.73%)
Total	29 (42.02%)	40 (59.97%)	69 (100%)

The performed analysis (table 2) indicates that basic EMS units support their activities with teletransmissions more often (59,97%) than specialised EMS units (42,02%). The decreasing number of teletransmissions performed between November 2011 and January 2012 signifies seasonal variation in the prevalence of ACS.

The table 3 shows the number of patients in the case of whom, following a teletransmission, a decision on transportation to the appropriate specialised medical facility was made. Out of 69 (100%) of performed teletransmissions, 39 (56.52%) ended up with transportation of a patient directly to the invasive cardiology ward, passing over the emergency cardiology ward. The remaining 30 patients (43.47%) were transported to another cardiology ward. Due to teletransmission, an invaluable

time for patients with recent myocardial infarction of STEMI type was saved. None of the patients in the case of whom a decision on teletransmission was made was left at home. It shows that there was a suspicion of ACS of NSTEMI type or unstable angina without changes in ECG records.

Table 3. Transportation of patients to AHP or another emergency cardiology ward

	November 2011	December 2011	January 2012	Total
AHP	19 (27.53%)	10(14.49%)	10(14.49%)	39(56.52%)
Cardiology ward	12(17.39%)	13(18.84%)	5(7.24%)	30(43.47%)
Total	31 (44.92%)	23 (33.33%)	15 (21.73%)	69 (100%)

Table 4. Mean EMS response time to reach a patient and travel time required to transport a patient to the final treatment destination

	Mean EMS ambulance response time to reach a patient [min]	Mean travel time required to transport a patient to the final treatment destination [min]
Period of time from November 2011 until January 2012	6.7 minutes	46.3 minutes

Having analysed the EMS ambulance response time (table 4), it may be stated that reaching the emergency site took on average 6.7 minutes, whereas transporting a patient to the final treatment destination took 46.3 minutes. EMS teams need this time to carry out basic life support activities, such as physical examination, taking medical history, performing a 12-lead ECG, teletransmission and arriving at a specialised medical care facility. The key factor predetermining the time is the distance to be covered from the place of call to the place of treatment. According to the demographic data obtained for Bielsko-Biała district 70% of population live in rural area, far away from hemodynamics ward in hospital. The call received by a dispatcher, implying that a particular patient may be at risk of acute coronary syndrome (ACS), constitutes an indication that the ambulance response should be given the highest priority level.

The table 5 shows the average age of patients, in the case of whom teletransmission was performed. The average age of patients who were not diagnosed for ACS of STEMI type was 69 years, while the average age of patients with ACS other than STEMI, transported to the hemodynamics lab, was 57.6 years.

Table 5. Average age of patients in the case of whom teletransmission was performed related to the age of patients transported to AHP

	Average age in years
Teletransmission performed	69.1
Transportation to AHP	57.6

4 Conclusion

The results of the study illustrate the significance of teletransmission in the system of Polish Emergency Medical Services. The review of literature indicates a multidimensional application of teletransmission [1, 3, 5] with regard to the patient himself/herself and EMS team members. From the patient's perspective, teletransmission brings in a definite improvement in the quality of emergency services, it provides access to specialised consultation at home of the sick person and enables application of specialised treatment already on site. While analysing the incidents from the point of view of the EMS team, performance of teletransmission constitutes an extremely important element of a diagnostic process. The EMS team may avail themselves of specialist knowledge already on site. Analysing the situation further from the perspective of a two-member EMS team, it may be definitely concluded that teletransmission adds a new dimension as it constitutes an additional team member.

Papers [5, 9] indicated a particular importance of teletransmission by emphasizing that time saving is the main advantage of teletransmission, which, in the case of ACS of STEMI type, plays a crucial role. Thanks to the transmission of data there arises a possibility to transport a sick person directly to the facility where he/she will be administered treatment, without wasting time on additional diagnosing at the level of a municipal or district hospital. The data presented by the a.m. authors in their studies stress the fact that due to teletransmission the frequency rate of severe damage to the cardiac muscle diminishes and at the same time mortality rate induced by ACS of STEMI type [1, 7, 8] is also reduced. The present study confirms that the application of this method considerably influences the quality of life of persons who have suffered STEMI, it improves a sense of social safety by ensuring access to appropriate treatment methods in a very short period of time.

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