Study regarding the survival of patients suffering a traumatic cardiac arrest

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Abstract
Severe trauma is the most frequent cause of death in young people, in civilized countries with major social and vital costs. The speed of diagnostic decision making and the precocity of treatment approaches are both essential and depend on the specialists’ collaboration.

The present study aims to emphasize the actual situation of medical interventions in case of cardiorespiratory arrest due to trauma. 1387 patients who suffered a cardio respiratory arrest both traumatic and non-traumatic were included in order to point out the place of traumatic arrest.

Resuscitation of such patients is considered useless and resource consumer by many trauma practitioners who are reporting survival rates of 0%-3.5%. As the determinant of lesions, trauma etiology was as it follows car accidents – 43%, high falls – 30%, suicidal attempts – 3%, domestic violence – 3%, other causes – 21%.

Hypovolemia remains the major cause of cardiac arrest and death and that is why the efforts of emergency providers (trauma team) must be oriented towards “hidden death” in order to avoid it. This condition could be revealed and solved easier with minimal diagnostic and therapeutic maneuvers in the emergency department.

Background
Severe trauma has become the most frequent cause of death in young people, in civilized countries. For this reason, it is obvious that a proper approach in the Emergency Department becomes mandatory and with a maximum impact upon the patient’s survival.

The speed of diagnostic decisions and the precocity of treatment approaches are both essential and depend on the specialists’ collaboration and the existence of an algorithm in which everyone has the chance to apply his/ her experience for the patient’s maximum benefit.

The present study aims to emphasize the actual situation of medical interventions in case of cardiorespiratory arrest due to trauma and the importance of prompt and well-oriented maneuvers that can prevent cardiac arrest installation.

Resuscitation of such patients is considered useless and resource consuming by many trauma practitioners who are reporting survival rates of 0%-3.5% [1-3,7]. Everybody in the world knows the importance of Advanced Trauma Life Support guidelines of the American College of Surgeons in establishing the order of operations when treating multiple trauma patients, but their recommendations for the interruption of resuscitation or not to resuscitate cannot be applied everywhere and in every situation [4].

That is why, in this study, except for patients who were already dead at the moment of their arrival in the hospital, we considered that everybody had at least one chance to be resuscitated [11].

Material and Method
The study included the patients who suffered both traumatic and non-traumatic cardio respiratory arrest in order to point out the place of traumatic arrest among the total cardiac arrests. 1387 patients were admitted between January 2007 and December 2012. The individual parameters followed were: age, gender, place of cardiac arrest, causes of cardiac arrest, and were processed by using Excel 2007. Trauma patients were considered those who suffered car accidents, violence, burns, electrocution, hanging, drowning.

The patients were admitted in the Emergency Department of “Sf. Pantelimon” Emergency Hospital in Bucharest and received medical assistance from a complex team made up of emergency physicians, surgeons, orthopedists and neurosurgeons, critical care specialists, cardiologists, imagistic specialists trained in emergency care with at least 5 years of experience.
Results

The distribution of patients according to each year of study was the following: 2007 – 192, 2008 – 198, 2009 – 231, 2010 – 240, 2011 – 267, 2012 – 259.

Gender distribution was suggestive with male predominance – 924 and 463 women:

| Age group                  | Patients |
|----------------------------|----------|
| 1-20 years old            | 106      |
| 21-40 years old           | 242      |
| 41-60 years old           | 380      |
| 61-80 years old           | 455      |
| over 80 years old         | 204      |

Most patients – 862 out of 1387 were living in an urban environment, which could be explained by an increased accessibility to medical services and to emergency assistance, but the differences of mentality could also be involved. In both urban and rural environments, males predominated over women – 619/289 in urban and 305/174 in rural area. This can be explained by a more active and dangerous life experienced by men and a more aggressive behavior from their part.

Regarding the distribution on age groups, most patients were part of the 61-80 group, followed by those who were 41-60, and the average age was 54+/- 1.3, slightly raised for women.

Considering the predominant place the cardiac arrest was encountered, this appeared to be the street, followed by the place of living, public spaces, medical institutions, place of work, in this order. These results correlated with the most frequent age at which cardiac arrest took place, namely the persons most active both from a social and a professional point of view.
Out of 1387 patients, 105 were resuscitated in the prehospital field, 42 died during transport and 1240 were resuscitated in the emergency department.

Regarding the first rhythm recorded before resuscitation, in the out of hospital field, this was asystole for most of the cases, followed by ventricular fibrillation, pulseless electrical activity and then ventricular tachycardia. For those who were resuscitated in the Emergency Department, most presented with ventricular fibrillation as the first monitored rhythm, followed by asystole, pulseless electrical activity and ventricular tachycardia [21].

It could be easily observed that the percentage of cases of asystole was higher in case of out of hospital resuscitation patients when compared with those resuscitated in hospital areas and this was probably because the coronary disease was the main cause of cardiac arrest, as compared with more diverse pathology and causes which characterized the second situation.

There were certain patients who suffered at least one more cardiac arrest. In the group represented by prehospital cardiac arrest, the dominant rhythm was asystole, as it can be seen below. This characterizes even the hospital group but the numbers are different.

Ventricular tachycardia was present in a slightly high percentage than the first rhythm monitored at the first cardiac arrest, sustaining the idea that cardiac arrest could occur through pulseless ventricular tachycardia which can rapidly turn into ventricular fibrillation.
Regarding the etiology of cardiac arrest in our group, most of cases presented with cardiovascular disease, followed by respiratory diseases, trauma, cerebrovascular diseases, asphyxia, toxic etiology and suicidal attempts. Considering the last three as traumatic events because they were encountered in such conditions, most of them will go up on the second place in this classification due to traumatic causes.

In our study, there was no significant statistical correlation between ISS value and the presence of cardiac arrest [9], the average value for ISS being 29.27±13.95.

Regarding survival, 126 patients without cardiac arrest have survived and 9 out of 261 with cardiac arrest, as well, which means 3.44%, which correlates with other studies [4]. 48 out of these patients have survived the first cardiac arrest event and the 9 who were discharged come from that group. The main cause of cardiac arrest was hypovolemia in the 4 cases of those who survived, hypoxia and severe cerebral trauma in 2 cases, and pneumothorax in one case.
Discussions and Conclusions

This study was an observational and retrospective one. Even if there were no data available regarding the long-term survival on discharge, it offered some results that could be interpreted as suggestive for rates of survival in cases of a certain lesion [5]. In the same time, it created an image on what happens with a traumatized patient in the Emergency Services. According to a recent study, the survival of trauma patients after resuscitation is still uncertain, with poor results that vary between 0 and 3, 47% [4].

Most frequent causes of trauma in our group of patients were hypovolemia, severe cerebral trauma, hypoxia, tension pneumothorax.

As the determinant of lesions, trauma etiology was the following: car accidents – 43%, high falls – 30%, suicidal attempts – 3%, domestic violence – 3%, other causes – 21% [15,16]. Regarding lesions type, the following could be met: cerebral trauma of different grades – 57%, thoracic lesions – 30%, extremities – 37%, abdomen and pelvis – 17%, spinal lesions – 14% [15,16].

The unsuccessful resuscitation of patients with traumatic cardiac arrests similar with other recent data emerged from different studies [6,7,10]. No matter the cause, the success in this situation is not as good as the cardiac arrest in out of hospital field.

Regarding the neurologic outcome at the discharge moment, even in our group, the best results were registered by those who suffered cardiac arrest induced by hypoxemia [1], followed by those with penetrating thoracic trauma who necessitated minimal interventions in the emergency department, without big thoracotomy, which was performed in the operating room and which announced greater traumatic and vital lesions [1,4,8].

This study was somehow limited and its results should be interpreted by taking into consideration the aspect that it was developed in one single center and the number of patients was relatively small. Nevertheless, the results were comparable with the ones in other similar studies, which used even smaller groups of patients and could represent a landmark for future studies. Essentially, the applicability of a certain algorithm should be adapted to local conditions and should include the close collaboration between all specialists involved. The algorithm must have, as a central element, resuscitation, and preservation of vital signs.

As a conclusion, this study, which was similar to others when outcomes were analyzed, confirms the poor survival rate of the trauma – cardiac arrest combination. Hypovolemia remains the major cause of cardiac arrest and death and that is why the efforts of emergency providers (trauma team) must be oriented towards the early diagnosis of potentially lethally lesions before cardiac arrest. Survivors are selected, with different chances, mostly from the subgroups of trauma patients potentially dead and a special one is that represented by hypoxia. This condition could be easily revealed and solved with minimal diagnostic and therapeutic maneuvers in the emergency department and even on scene: asphyxia, foreign bodies in the upper airway, tension pneumothorax.

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