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STUDY ABOUT OUT OF HOSPITAL CARDIAC ARREST RESUSCITATION OUTCOME

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Abstract: *Introduction: Romanian Mobile Emergency Service for Resuscitation and Extrication known as SMURD is a functional system that deals with daily emergencies and mass casualties. The study analyses the performance of the system considering both paediatric and adult cardiac arrest cases. Materials and Methods: The national database consists of 589873 cases, on a period of 3 years (01.01.2010-31.12.2012). So, a total of 9756 cardiac arrests cases that benefited from cardiopulmonary resuscitation (CPR) manoeuvres were extracted. Results: Return of Spontaneous Circulation (ROSC) rate for all 9515 adult cases was 8,38% and for all 241 paediatric cases, ROSC rate was 6,64%. The most frequent adult ⇔ paediatric cardiac arrest rhythm is asystole (87% ⇔ 78%) followed by pulseless electrical activity (7% ⇔ 8%) and ventricular fibrillation (6%⇔ 14%). Better results are found in adult resuscitation than in paediatric ones. Conclusions: Analysing the results we can conclude that the most frequent rhythm of cardiac arrest is Asystole. The chances of achieving ROSC by the time the patient is admitted to hospital are considerably lower in paediatric. Ventricular Fibrillation/Ventricular Tachycardia (VF/VT) is less frequently encountered in paediatric patients compared with adult cardiac arrests.*

INTRODUCTION

Error reduction in prehospital resuscitation is a worldwide priority. All modern emergency systems take actions to improve or fix the errors in applying the emergency protocols.

When every aspect of the survival protocol is in the right place, the outcome is often still not as expected. Today most patients still fail to respond to even the best care in the highest-performing Emergency Medical Services (EMS) systems.(1)

The Romanian Mobile Emergency, Resuscitation and Extrication Service, known as SMURD is a valuable national emergency care system, which consists of both intensive care (type C) and first aid (type B) mobile units. Romania is one of the very few countries in Europe where the patient has a right of free of costs emergency care. Being rescued or accessing emergency healthcare is addressed to everybody without condition.

SMURD is a functional system that deals not only with daily emergencies, but also disasters and mass casualties. Since its appearance this medical care service has been under a continuous development process.

AIM

The aim of this study is to analyse and acknowledge the performance of the system considering both paediatric and adult cardiac arrest cases.

This study is done at national scale. Our focus as health care providers is on how we can improve and maximize efficiency of the system we are part of by emphasizing some of the issues we have confronted with during our work and suggesting potential solutions. Considering the initial experimental character of SMURD, we are placing additional attention on acknowledging the overall efforts and work of our health providers demonstrated both by the large number of patients assisted and medical outcomes.

MATERIALS AND METHODS

The national database consists of 589873 cases, on a period of 3 years (01.01.2010-31.12.2012). The database is reorganized in such way to allow complex mathematical processing based on Structured Query Language (SQL) interrogation.

The commonly used element in comparing performances is Return of Spontaneous Circulation (ROSC) by the time the ambulances arrived to hospital. The study takes interest in prehospital cardiac arrest rhythms and the rate of ROSC at the time of patient hospitalization. These parameters are selected in many other important studies as standard to evaluate the performance and improve the outcome of the medical procedures.(2)

A selection of cases was done from the total amount data. So, a total of 9756 cardiac arrests (241 paediatric, 9515 adult) cases that beneficiated of CPR manoeuvres were extracted. This etalon was analysed from multiple points of views: rhythm of cardiac arrest, ROSC, urban and rural background, comparison of outcomes between type B and C ambulances.

Data contains medical details of the case: reason for calling 112, patient status at medical team arrival, Glasgow Coma Score, type of affliction, initial and final vital signs, and

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treatment conducted. This information was collected through standardized reports elaborated after each intervention which were afterwards centralized and absorbed into a national database.

RESULTS

ROSC rate for all 9515 adult cases is 8,38% and for all 241 paediatric ROSC rate is 6,64% by the time they get to the emergency department (ED). This rate does not mean complete survival of the patient but only the vital signs being present. This represents a critical condition for all patients intended for full recovery.

Type of cardiac arrest rhythm change both medical protocol and recovery expectation. Different resuscitation parameters directly depend on type of cardiac arrest rhythm and early recognition of this aspect is essential. It is well known that ventricular fibrillation rhythms are found in early stages and better output is expected when this rhythm is present. Fast recognition and quick medical response create a big positive advantage.

The most frequent adult ⇔ paediatric (figure no. 1, figure no. 2) cardiac arrest rhythm is asystole (87% ⇔ 78%) followed by pulseless electrical activity (7% ⇔ 8%) and ventricular fibrillation (6% ⇔ 14%).

Figure no. 1. Adult cardiac arrest rhythm

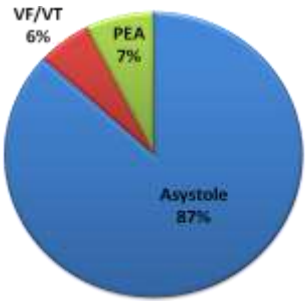
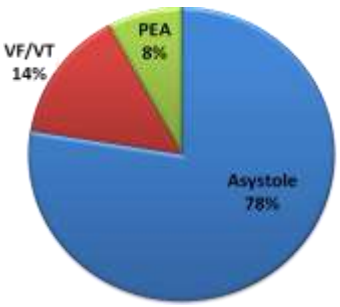


Figure no. 2. Paediatric cardiac arrest rhythm



Comparing the rhythms of cardiac arrests for type C ambulances, the greatest rate of success was achieved when VF/VT was present, followed by PEA and Asystole.

The age of the patient is important. Better results are found in adult resuscitation than in paediatric ones with only one exception. For PEA paediatric patients have a better output (27% > 15%) (figure no. 3).

A Type C ambulance brings most of the cutting-edge medical protocols in place. Bigger and superior prepared medical team is also available, so this aspect explains better output in resuscitation manoeuvres.

Analysing adult cardiac arrests emergencies, the rate of ROSC for type C ambulance is much better than for cases attended by type B ambulances. (Asystole 9% <> 2%, VF/pulseless VT 32% <>8%, PEA 15% <> 3%) (figure no. 4).

Figure no. 3. Rate of resuscitation for different rhythms of cardiac arrests

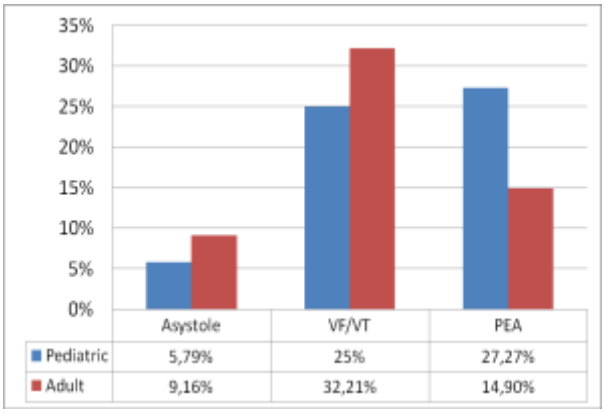
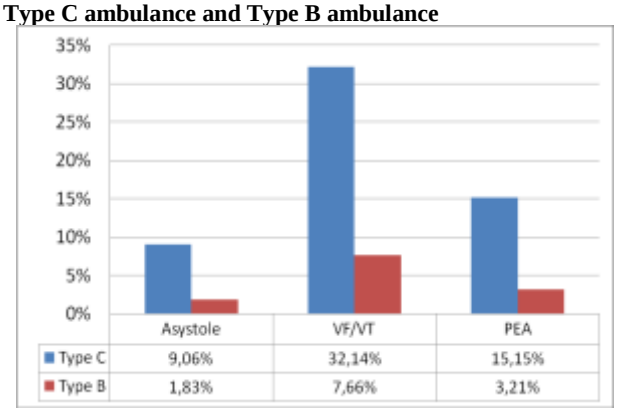


Figure no. 4. Comparison of rate of resuscitation between Type C ambulance and Type B ambulance



Superior results for advanced ambulances (Type C) against first aid ambulances (Type B) is a certitude in all relevant resuscitation studies.(3)

DISCUSSIONS

There have been several studies investigating the factors associated with successful cardiopulmonary resuscitation and ROSC in non-traumatic prehospital cardiac arrest cases. This subject is of high interest as there is not limit in improving the strategy of prehospital cardiac arrest assessment.(3)

Prehospital resuscitation is well studied as this kind of emergency occurs very often and is dramatic by its consequences. So, several other parameters are of interest such as an early phone call for the ambulance, bystander CPR, presentation with ventricular fibrillation or tachycardia, medication.(3)

There are studies that highlight the fact that in out-of-hospital cardiac arrest, 10–50% of patients have return of spontaneous circulation (ROSC) before hospital arrival. Certain aspects are to be investigated, like the relation between time-to-ROSC and survival to determine the optimal timing of transport to the hospital in patients without return of spontaneous circulation.

In cardiac arrest patients with prehospital ROSC, survival significantly decreases with increasing time spent to ROSC. Studies shows that around 90% of survivors had achieved ROSC within the first 15 min of EMS resuscitation.(4)

Relationship between cardiopulmonary arrest and resuscitation durations and survival after out of hospital cardiac arrest still represent an important issue. An important aim of several studies is to determine the association between survival

output without neurologic sequelae and cardiac arrest intervals in the setting of witnessed out of hospital cardiac arrest.(5)

For paediatric cases, the selection of ambulance type makes sense to be rather an advanced ambulance comparing with a regular first aid ambulance and it is well known that emergency cases in children are highly unpredictable, and studies show that a least one medication error was observed in every simulated resuscitation case.(6)

Recent reviews on CPR indicate that paediatric out of hospital cardiac arrest is not a very common event and is generally described as having exceptionally poor survival with severe neurological sequalae. New devices and technology are more and more often used to improve paediatric resuscitation and several studies point to this aspect. The quality of paediatric resuscitation significantly improved when using real-time feedback.(7)

CONCLUSIONS

Analysing the results, we can conclude that for prehospital the most frequent rhythm of cardiac arrest is asystole, in both paediatric and adult patients. This is also explained by the fact that it takes some time to arrive with a mobile unit on the site. Most of the studies underline the same aspect: time is critical.

Age of the patient is another parameter that have an important impact. The chances of achieving ROSC by the time the patient is admitted to hospital are considerably lower in paediatric patients than in adult ones. More resources are required by children with poorer outcome. This is important when resources are allocated making paediatric cases more delicate.

Although cases having a no shockable rhythm have a worse prognosis than patients in the situation with a shockable rhythm (VF), outcomes after PEA appear to be improving. Shockable rhythms like VF are less frequently encountered in paediatric patients compared with adult cardiac arrests, lowering the chances for ROSC achieving.

Patient's chances of survival are greater when attended by a type C ambulance comparing with a type B ambulance. This is a good reason to select the proper type of ambulance to attend cardiac arrest. Paediatric cases bring even more complexity.

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