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Do Prehospital Resuscitations Performed by Medical Emergency Services Make a Difference? A Report on Resuscitations Performed in an University Hospital

Hastane Öncesi Resüsitasyonda Acil Sağlık Hizmetleri Bir Fark Yaratıyor mu? Bir Üniversite Hastanesi Acil Servisinde Yapılan Resüsitasyonların Analizi

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ABSTRACT Objective: In this study, we aim to investigate the effect of medical emergency service, whether it is used or not, on cardiopulmonary resuscitations (CPR) of patients who presented with cardiopulmonary arrest (CPA) in our emergency department (ED). **Material and Methods:** All patients who received CPR in the emergency department (ED) of an university hospital from 01.01.2013 to 31.12.2013 were surveyed retrospectively. Age, gender, cardiac activity in presentation (CPA or spontaneous circulation present), their way of transport to ED (via emergency ambulance service or other), duration of CPR, whether CPR was performed or not during patient transfer, outcome of CPR and lactate levels were recorded. **Results:** Two hundred and eight patients were included in the study. One hundred and nine patients (52.4%) presented with CPA and 99 patients (47.6%) developed CPA in ED. Ninety four of those 109 patients with CPA in presentation were transported by an ambulance while CPR was in progress and 36 of them responded CPR which was continued in ED. On the contrary, of 15 patients who were brought by untrained friends and family without CPR, only 5 responded CPR which was performed in ED. The correlation between being transferred by ambulance or by other means and the result of CPR in ED was found statistically insignificant ($p=0.475$). However, return of spontaneous circulation rates for in-hospital CPAs were significantly higher ($p<0.001$). **Conclusion:** The close success rates of patient survival in non-professional patient transport without any CPR effort and profesional transport by prehospital medical emergency service are both confusing and alarming. Prehospital medical care must be thoroughly studied and all problems should be addressed by the authorities.

Key Words: Cardiopulmonary resuscitation; heart arrest; emergency service, hospital; emergency medical services

ÖZET Amaç: Bu çalışmada, acil servise kardiyak arrest durumda getirilen olguların transferi sırasında ambulans sisteminin kullanılıp kullanılmamasının acil serviste uygulanan kardiyopulmoner resusitasyona (KPR) olan etkisini araştırmayı amaçladık. **Gereç ve Yöntemler:** Bir üniversite hastanesi acil servisinde retrospektif olarak yapılan çalışmada 01.01.2013 ve 31.12.2013 tarihleri arasında acil serviste KPR yapılan tüm hastalar incelendi. KPR uygulanan hastaların yaş, cinsiyet, geliş şekilleri (spontan dolaşımlı veya arrest), ulaşım aracı (Ambulans sistemi veya hasta yakınına ait araç), KPR süresi, hastaneye transfer esnasında KPR yapılıp yapılmadığı, acilde uygulanan KPR' nin sonucu, laktat düzeyleri kaydedildi. **Bulgular:** Çalışmaya alınan 208 hastanın 109'unun (%52.4) arrest halde getirildiği, 99'ununsa (%47,6) acil serviste arrest olduğu saptandı. Arrest durumda getirilen 109 hastanın 94'ü ambulans sistemleriyle KPR yapılarak getirilmiş olup, 36' sı acilde devam edilen KPR' ye cevap verdi. Buna karşılık, hasta yakınları tarafından KPR yapılmadan getirilen 15 hastanın 5'i acilde uygulanan KPR' ye cevap verdi. Ambulans sistemi ya da hasta yakını ile getirilmiş olmanın acil serviste uygulanan KPR sonucuyla olan ilişkisinin istatistiksel anlamlılık taşımadığı saptandı ($p=0,475$). Bununla birlikte, acil servis takibi sırasında gelişen arrestlerde KPR sonrası spontan dolaşımın geri dönmesi, istatistiksel olarak anlamlı idi ($p<0,001$). **Sonuç:** Hastane öncesi acil sağlık sisteminin, hasta yakınlarının hastalarına resüsitasyon yapmadan sadece ivedilikle hastaneye transfer ederek elde ettiği başarı ile eşdeğer sonuçlar alması şaşırtıcı ve ürkütücüdür. Hastane öncesi sağlık bakımına ait eksiklikler, ilgililerce hızla araştırılmalı ve düzeltilmelidir.

Anahtar Kelimeler: Kardiyopulmoner resusitasyon; kalp durması; acil servis, hastane; acil tıbbi servisler

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Cardiopulmonary arrest (CPA) is the state caused by the cease in cardiac functions or loss of pulse in major arteries, characterized with respiratory arrest and a sudden and unexpected loss of consciousness.[1] In order for the patients to survive this state, all steps of resuscitation from identifying CPA to cardiopulmonary resuscitation (CPR) should be effective and well coordinated. Survival rate of prehospital CPAs is known to be low, estimated to be between 0% to 46%, and varies by region.[2]

In this study, we investigate the demographic properties and the success rate in resuscitation of patients who received CPR after CPA. Also, another goal was to compare the success rate of resuscitation in patients who presented with CPA and patients who developed CPA during their stay in emergency department (ED).

MATERIAL AND METHODS

This retrospective study was held in Department of Emergency Medicine of XXX Hospital from 01.01.2013 to 31.12.2013. The study protocol was conducted in accordance with the Helsinki Declaration 2008. We included patients who presented with CPA or who developed CPA during their stay in ED and on whom CPR is performed. Patients whose data is not valid or not recorded were excluded. During the 1 year period of the study, number of CPRs performed was 242, but 34 patients had to be excluded due to insufficient data or problems in hospital automation system, therefore a sum of 208 patients was decided to be included in the study.

CPR was performed following the protocols of 2010 AHA Advanced Cardiac Life Support Guidelines. Age, gender, cardiac activity on presentation (with spontaneous circulation or CPA), way of transport (via ambulance or other), duration of CPR, outcome of CPR, serum lactate levels were recorded for each patient. CPR was considered successful when spontaneous heart beats and continuous blood pressure were obtained. Qualitative data was presented with numbers and percentages, while arithmetic mean ± standard deviation and 95% confidence intervals were used for quantitative data. Pearson's chi-squared test and Pearson correlation coefficient was used as statistical methods. Data analysis was performed on SPSS 16. P value under 0.05 threshold was accepted as statistically significant.

RESULTS

During the time period of the study, CPR was performed on 242 patients. Two hundred and eight of those patients had complete data. None of the 208 patients had a history of trauma, therefore considered as non traumatic CPAs. One hundred and twenty five patients (60.1%) were male and 83 patients (39.9%) were female. Mean age was 65.96±16.85 years (95% CI: 63-68%). The most common time interval during which the most patients were presented (39.4%, n=82) was between 08:00 am and 17.00 pm. The second busiest time interval was between 17.00 pm and 24.00 pm during which 74 (35.6%) patients were presented. 69.2% of all patients (n=144) were transported by ambulance.

One hundred and nine (52.4%) patients were presented with CPA and 99 (47.6%) developed CPA during their stay. 51% (n=106) of all CPRs resulted in death. Of those 106 patients, 78 (73.58%) was brought with ongoing CPR by medical emergency service and 28 of them used other means of transport without any resuscitative efforts (Table 1).

66.7% (n=10) of the 15 patients who weren't transported by ambulance and who didn't recieve CPR during transport, didn't respond to CPR performed in ED and were pronounced dead, while only 36 (38.3%) of 94 patients who used medical emergency service had a positive outcome after CPR. No statistical significance was found between the way of transport (whether by ambulance of by other means) of the patients with CPA (p=0.475).

When the return of spontaneous circulation (ROSC) after CPR in patients who presented with CPA and patients who crashed in ED was studied; 61.6% (n=68) of patients who developed CPA during their stay in ED had a positive outcome, while in 62.4%(n=68) of 109 patients who presented with

TABLE 1: Cardiopulmonary resusciation (CPR) outcomes of patients who were transported by ambulance of by other means.

	CPR outcome		
Way of transport	**Exitus n (%)**	**ROSC n (%)**	**Total n (%)**
Ambulance	78 (54.2%)	66 (45.8%)	144 (69.2%)
Other	28 (43.8%)	36 (56.2%)	64 (30.8%)
Total	106 (51%)	102 (49%)	208 (100%)

(p=0.165) (Pearson's chi-squared test).

TABLE 2: Cardiopulmonary resusciation (CPR) outcomes according to presentation.

	CPR outcome		
Presentation	**Exitus n (%)**	**ROSC n (%)**	**Total n (%)**
Spontaneous Circulation Present	38 (38.4%)	61 (61.6%)	99 (47.6%)
Cardiopulmonary Arrest	68 (62.4%)	41 (37.6%)	109 (52.4%)

(p<0.001) (Pearson's chi-squared test).

CPA didn't respond CPR. ROSC after CPR of patients who crashed in ED was statistically significant (p<0.001) (Table 2).

Correlation between prolonged CPR and increased mortality is another statistically significant finding in our study (p<0.001). The mean duration of CPRs with a negative outcome was 33.62±10.54 minutes while ROSC was obtained after 20.58±13.01 minutes in CPRs with positive outcome.

Patients who developed CPA in ED was resuscitated for 24.54±13.57 minutes (95% CI 21.83±27.24) and their serum lactate levels were 7.65±5.13 mmol/L (95% CI 6.34±8.38). The mean duration of resuscitation in patients who were transported by ambulance with ongoing CPR was 29.44±12.84 minutes (95% CI 27.20±32.14) and their lactate levels were 11.34±5.52 mmol/L (95% CI 10.49±12.52). Correlation between the duration of CPR and lactate levels was poor but found statistically significant (p=0.010, r=0.179) (Table 3).

TABLE 3: Correlation between Cardiopulmonary resusciation (CPR) durations and lactate levels of witnessed and non-witnessed cardiopulmonary arrests.

Presentation	**CPR duration (minutes)**	**Lactate level (mmol/L)**
Spontaneous circulation present	24.54	7.36
CPA transported by ambulance	29.44	11.34

(p=0.010, r=0.179) (Pearson's chi-squared test).
CPA: Cardiopulmonary arrest.

DISCUSSION

Advanced cardiac life support covers all the advanced techniques performed by trained professionals for a safe and continuous airway as well as all the necessary actions in order to obtain a stable cardiac rhythm.[1]

Importance of the quality of CPR was underlined in AHA Guidelines which revised in 2010.[3] According to these guidelines, an effective CPR is not only for the return of spontaneous circulation but also for providing all the components of a higher quality of later life. Therefore, main goals of resuscitation are both the return of spontaneous circulation and rehabilitating the patient to his or her previous functionality. As mentioned in 2010 AHA guidelines, for a better neurological outcome after a successful resuscitation and ROSC, early and uninterrupted chest compressions and early defibrillation are of major importance. Effective chest compressions are discussed in a 289 patient study in 2012.[4] In 141 of 289 cases of out of hospital CPAs, cardiac compressions were started before the analysis of initial rythym and in 148 patients initial rythym was first analysed, and then if necessary, compressions were started. While ROSC results were found similar 26.2% and 33.1% respectively, hospital discharge rates were 43.2% in compression first group and 22.4% in analyse first

group. This data may show that early compressions are necessary for a better neurological outcome. In our study, since they are not recorded, we fail to gather all data regarding time of arrests, time until beginning of CPR, whether CPR was effective and the presenting rythym on monitor. However, medical emergency service recorded that all the CPA cases were transported while CPR was on progress. No attempt of CPR was performed by the friends and relatives of the 15 patients who were brought to ED without an ambulance. That being said, a study by Mikkelsen et al. demonstrated the results of CPR tend to differ according to the performance of the medical personnel performing it.[5] Of 25 647 patients who needed medical emergency service, 701 (2.7%) needed life saving interventions. Five hundred and ninety six patients (2.3%) needed more complicated interventions which a paramedic or emergency medical technician could handle. This study suggests that the capabilities of resuscitation performer is another issue to be considered. On the contrary, another study compared results of 977 CPRs according to the medical staff who performed them.[6] No difference was recorded for patients who were treated by medical doctors or paramedics. Survival rates were 34% vs. 33% (p=0.74) and achieving ROSC were 28% vs. 25% (p=0.50) respectively. In our study the performer of resuscitation, whether a medical doctor, a paramedic or an emergency medical technician is unknown. Also, because the medical records after hospital admissions were not surveyed, the short term and long term survival rates of admitted patients are unknown. ROSC until hospital admission was considered as a successful resuscitation. Therefore we could only compare ROSC and lactate levels according to the way the patients were transported. Even with the lack of this data, the close percentages of ROSC in 36 of 94 CPAs (38.3%) who were transported by ambulance and 5 of 15 (33.3%) patient who were brought by friends and family might still be considered as alarming.

Ventricular fibrillation (VF) or pulseless ventricular tachycardia (VT), when present in a witnessed arrest, are known to have the largest survival rate in all age groups.[7] Accordingly, in our study, success rate of CPRs in witnessed CPAs in ED is better than the success rate of prehospital CPAs, whether they were transported by ambulance or by other means. But we found that CPR outcomes of patients who were transported with ongoing CPR by trained medical staff by ambulance and who were brought in by untrained witnesses by other ways of transport with no resuscitative efforts were similar. While a higher success rate is expected in CPAs which occurs in hospitals, the similar outcomes of prehospital emergency service and non- professional transfer are confusing and had to be addressed. For a better outcome, CPR must be performed early, effectively and continuously. Our results may be due to poor CPR during transport or prolonged arrival time of ambulances. Also, cultural factors, regulations, problems with insurance, avoidance of financial responsibilities may result in all patients with CPA ending up in ED.[3] In a retrospective study in 2010, 1985 non-traumatic prehospital CPA cases were surveyed. For all cases emergency ambulance service was activated. This study indicate that CPR was performed by ambulance staff in only 715 (36%) patients and 545 (76%) of them were transported to a hospital.[8] This data in the literature can be considered to be a great example of the unnecessity of transporting all prehospital CPAs to a hospital. This may be another reason behind our results.

By all means, CPR may not be indicated in all patients with CPA. Likewise, approaches to end point of CPR can differ. Latest studies suggest that the number of unnecessary resuscitations can be diminished by accepting a recent, standard and signed do not resuscitate (DNR) form as well as a verbal DNR demand.[9,10] In addition, 2010 AHA Guidelines suggest that if patients cannot be resuscitated by advanced cardiovascular life support (ACLS) protocols in field, they also cannot be resuscitated in hospitals.[3] Therefore, emergency staff in ambulances should be aware of the concept that all CPA patients are not to be transported to a hospital and such expectations should not be tolerated in community. It should be kept in mind that all

unnecessary activations of emergency ambulance service may delay a life saving intervention for a real emergency.

Another reason behind the similar success rates of professional and non-professional patient transport may be delays in identifying CPA and beginning of CPR. Gasping in patients with CPA may be misdiagnosed as seizures or respiratory effort. Because of these atypical presentations, rescuers may get confused and the activation of emergency ambulance service or beginning of CPR may delay.[3] As we stated in our study, mortality rates are close to each other in CPA cases who were transported either by ambulance (61.7%) or by other means (66.7%). These percentages match the mortality rates of patients who presented with CPA in literature.[2,8,11] This results may be interpreted as the lack of information and ability of the community in identifying CPA, performing early and effective CPR, and activating medical emergency service.

CONCLUSION

As a result, in order to have better CPR success rates, both the medical personnel and the community should have regular trainings on resuscitation and identifying CPA, and awareness on activating medical emergency service should be raised. For this purpose, educational television programmes and advertisements can be broadcast or this topic can even be covered on popular television shows with the supervision of professionals. Also, ambulance staff may be encouraged about performing and ending CPR on the field.

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