Analysis of Patients Whose Return of Spontaneous Circulation was Ensured and Invasive Coronary Revascularization was Performed Following Cardiac Arrest

Kardiyak Arrest Sonrası Spontan Dolaşımı Sağlanan ve Girişimsel Koroner Revaskülarizasyon Yapılan Hastaların Analizi

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Abstract: The aim of this study was to evaluate mortality and morbidity in patients referred to our emergency department with cardiac arrest and whom emergency coronary catheterization was performed. Between 2012-2015, patients who were referred to the emergency department of Eskisehir Osmangazi University Medical Center, Eskisehir, TURKEY with cardiac arrest and on whom emergency catheterization was performed after return of spontaneous circulation following cardiopulmonary resuscitation and with determined pathology on ECG were analyzed. A total of 15 patients (11 males) were included. The average duration of cardiopulmonary resuscitation was 18,60 minutes. Post-resuscitation ECG revealed ST segment elevaiton in 10 patients, ST-T changes in 4 patients, and nodal rhythm in 1 patient. Mean door-to-balloon time was 60,73 minutes (min: 27, max: 110). Following treatment, 9 patients were discharged while the remaining 6 were declared as exitus. Emergency coronary catheterization increases survival in patients who were referred to the emergency department following cardiopulmonary resuscitation. In patients referred to the emergency department with cardiac arest and in whom management is performed in accordance with related algorithms and return of spontaneous circulation, Emergency physicians should evaluate ECG rather quickly. Joint protocols of the Emergency and Cardiology Departments is important in terms of decreased mortality and morbidity for emergency coronary invasive treatment in patients with abnormal ECG findings

Key Words: invasive coronary revascularization, cardiac arrest, emergency department

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Öz: Çalışmamızın amacı hastanemiz acil servisine kardiyak arrest olarak getirilen ve acil koroner kateterizasyon yapılan hastalardaki mortalite ve morbiditeyi değerlendirmektir. 2012-2015 arası Eskişehir Osmangazi Üniversitesi Tıp Fakültesi acil servisine kardiyak arrest olarak nakli gerçekleştirilen ve kardiyopulmoner resüsitasyon sonrası spontan dolaşım sağlanan ve EKG'lerinde patoloji saptanıp acil kateterizasyona alınan hastalar incelendi. Değerlendirmeye 11'i erkek toplamda 15 hasta alındı. Yaş ortalamaları 57.80 (min:32, maks:85) idi. Hastaların tamamı 112 ambulans servisi ile getirildi. Hastaların ilk geliş EKG ritimlerinde 5'inde ventriküler fibrilasyon, 5'inde nabızsız elektriksel aktivite, 3'ünde asistoli ve 2'sinde nabızsız ventriküler taşikardi saptandı. Acil serviste yapılan KPR süresi ortalama: 18.60 dakika (min:10, maks: 40) idi. Post resüsüitasyon EKG değerlendirmelerinde 10'unda ST segment elevasyonu, 4'ünde ST-T değişiklikleri, 1'inde nodal ritim saptandı. Kapı anjiografi zamanı ortalama 60,73 dakika (min: 27, maks: 110) idi. Tedavileri sonrasında hastaların 9'u taburcu edilirken 6'sı eksitus kabul edildi. Acil serviste kardiyak arrest olarak getirilen, algoritmalara uygun şekilde müdahale edilen ve spontan dolaşım sağlanan hastalarda, acil servis hekimlerinin EKG değerlendirmelerini hızlıca yapmaları gerekir. Anormal EKG bulgusu saptanan hastaların acilen koroner girişimsel tedaviye alınmaları için acil servis ve Kardioloji bölümü ile ortak prtokoller hazırlanması mortalite ve morbiditeyi azaltması açısından önemlidir.
Anahtar Kelimeler: invaziv koroner revaskülarizasyon, kardiyak arrest, acil servis

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1. Introduction

In adult patients, cardiac arrest (CA), before hospital admission, is usually developed due to coronary artery disease (CAD) and often has a poor prognosis. Cardiopulmonary resuscitation (CPR) done compatible with the algorithms and post CA care may have a positive effect on the prognoses of selected patients. The guidelines recommend that once spontaneous circulation is detected, electrocardiogram (ECG) should be performed to establish the coronary pathology and in case the ECG revealed pathologic findings, early coronary angiography and revascularization should be performed. This, improves survival in ST-elevation myocardial infarctions (STEMI) and non-ST-elevation myocardial infarctions (NSTEMI) (1). Our study aimed to analyze the mortality and morbidity in patients with out-of-hospital CA whose return of spontaneous circulation (ROSC) were achieved at the emergency department (ED) with CPR, and on whom early coronary revascularization was performed.

2. Method

This retrospective study was conducted at University Medical Center ED in TURKEY between January 2012 and January 2015. The catheter laboratory was available any time for procedural intervention. The research protocol was approved by the local ethics committee. All patients were taken from the scene of the medical event by 112 (112 is Emergency Medical Service in Turkey), their first medical interventions were undertaken then they were transferred to our ED. The study included 15 patients referred to the ED with out of hospital CA, whose ROSCs were achieved following CPR at the ED and who had coronary angiography. The inclusion criteria consisted of age>18, comatose patients with ROSC after CPR and asystole, VF, VT during the arrest. The patients who did not have an angiography after ROSC, were excluded. The decision for an urgent coronary angiography was taken by an acute cardiac care physician and an interventional cardiologist. Patient demographics, comorbidities, rhythm before CPR, CPR time, post-CPR ECG samples, angiography reports, and hospital outcome reports were obtained retrospectively from the patient files and the hospital's automation system. Data was presented as a mean±standard deviation (SD) or n (%). All statistical analyses were done via the SPSS version 20.

3. Results

The demographics, CPR time, ECG findings, door-to-balloon time, coronary intervention results and clinical outcomes of 15 patients included in the study are listed in Table 1.

Table 1.

CASE	AGE	GENDER	ADDİTİONAL DISEASE	RHYTHM BEFORE CPR	CPR TİME (MİN.)	ECG AFTER CPR	DOOR TO ANGİO TİME (Min.)	CORONARY LESION	INTERVENTION	HOSPITALIZATION (Day)	OUTCOME
1	56	M	CAD,HT,DM	VT	40	NODAL RYHTHM	75	LAD	-	1	EXITUS
2	85	F	CAD, HT	PEA	22	STE	45	RCA	+	3	EXITUS
3	55	M	CAD	ASYSTOLE	10	STE	51	RCA	+	8	EXITUS
4	53	M	CAD	VF	15	STE	110	CX,LAD	+	6	DISCHARGE
5	64	F	-	VF	10	STE	42	LAD	-	8	DISCHARGE
6	60	M	CAD,HT	VF	30	STE	45	LAD	+	16	DISCHARGE
7	64	M	CAD,COPD,HT,DM	VT	34	ST-T CHANGES	82	CX	+	17	DISCHARGE
8	59	M	-	VF	12	STE	27	LAD	+	19	DISCHARGE
9	59	F	-	VF	15	STE	46	LAD	-	8	DISCHARGE
10	39	F	-	PEA	15	STE	52	-	-	12	DISCHARGE
11	53	M	-	PEA	10	STE	34	LAD	+	64	DISCHARGE
12	32	M	CAD	PEA	10	ST	76	-	-	41	EXITUS
13	60	M	CAD,DM	ASYSTOLE	20	ST-T CHANGES	68	LAD	+	28	DISCHARGE
14	56	M	CAD,HT,DM	ASYSTOLE	10	ST-T CHANGES	102	LAD,CX,RCA		1	EXITUS
15	72	M	CAD,ARF,HT,DM,	PEA	26	STE	56	RCA	+	2	EXITUS

CAD: Coronary Artery Disease, COPD: Chronic Obstructive Pulmonary Disease, HT: Hypertension, DM: Diabetes Mellitus, ARF: Acute Renal Failure
VT: Ventricular Tachycardia, PEA: Pulseless Electrical Activity, STE: ST Elevation
LAD: left anterior descending, RCA: right coronary artery, CX: Circumflex Coronary Artery

The mean age of the patients was 57,8 (min: 32, max: 85, SD: 12,278) years. When they were first admitted to the ED, in 5 patients ventricular fibrillation (VF), in 5 patients pulseless electrical activity (PEA), in 3 patients asystole, and in 2 patients pulseless ventricular tachycardia (VT) was detected. The mean time of CPR (first intervention of the health care team-ROSC time) was 18,6 minutes (min: 10, max: 40, SD: 9,804).

The ECG performed after ROSC revealed ST segment elevation (STE) in 10 patients, non-specific ST-T changes in 4 patients, and nodal rhythm in 1 patient.

The average time passed from the first intervention of the health care team the door-to-balloon laboratory was 60,73 minutes (min: 27, max: 110, SD: ±24,173). The mean time from the post ROSC to the angiography catheter laboratory was 42,133 minutes (min: 15, max: 95, SD: 24,69).

In 13 patients out of 15, coronary lesions were seen and 9 of them could be intervened. The patients rhythm at time of admission, coronary lesions, and clinical outcomes are listed in Table 1.

Following the interventions, all patients were transferred to the coronary intensive care unit. The mean hospitalization time was 15,6 days (min: 1, max: 64, SD: ±17,32). 9 out of 15 patients were discharged healthy with good neurologic outcomes, while the remaining 6 patients were declared exitus.

4. Discussion

Sudden CA is one of the most common causes of death. In adult patients, the most important cause of arrests consists acute coronary syndromes (ACSs) (2). In patients with CA without a previous diagnosis of significant structural cardiac disease, the prevalence of coronary lesions was also between 59% and 71% (3). Early diagnose of CA before referral to hospital is essential to start the life chain and to ensure survival. In out-of-hospital CAs, the primary goals of 112 medical services before patient's admission to a hospital are to maintain spontaneous circulation, to stabilize patient's vital signs, and to provide his/her fast transfer to an appropriate medical center. Early initiation start of CPR and early defibrillation may result in a 2 to-4-fold increase in survival (4).

The morbidity and the mortality of out-of-hospital CAs are high despite the contemporary technological developments. When all rhythms are considered survival is 10,7% and when the first detected rhythm is VF, then it is 21,2% (5). European Resuscitation Council guidelines recommend angiography and percutaneous coronary intervention (PCI) in ROSC patients, if their ECG reveals STE.

Coronary angiography is suggested in patients with STE following ROSC, however, many studies have stated that the cause of CA in ROSC patients may also be ACS even if there is no STE in their ECG (1,6). Nevertheless, the benefit of emergency cardiac catheterization in patients without STE is controversial (7,8). It is stated that in the condition of NSTE, the possibility to benefit from PCI is lower and the decision for PCI should be taken considering age, comorbidities, CPR time, and hemodynamic instability (9).

The first rhythm detected in the sudden CA patients is VF, in the range of 25-50% (10). In our patients, 5 had VF and 2 had pulseless VT as their first rhythm. In the literature, it is suggested that the first rhythm might be in accordance with VF at a high rate, however it is stated that asystole might develop until the first ECGs recorded by the first response medical team (11). The percentage of VF rhythm recorded by the first response medical team with automated external defibrillator (AED) within a short period of CA is 76% (12). Although all our patients were brought in by 112 health services, all the first rhythms detected by the medical team could not be obtained since their records could not be accessed.

In 80% of the ROSC patients whose ECG revealed STE or left bundle branch block (LBBB) an acute coronary lesion was detected (13). Most studies have pointed out that the ROSC patients had poor prognoses (14,15). Although there are no randomized and controlled studies conducted with patients with STE, observational studies favor early invasive treatment considering survival and neurological outcome (16,17). Therefore, the data collected from the out-of-hospital CA cases suggest an early referral to the centers with catheterization laboratories might be beneficial.

10 patients brought to our hospital ED in whom STE was detected following ROSC and 5 patients, who had previous CAD history or had significant cardiac symptoms before the arrest and carried risk factors for CAD, were transferred to the catheterization laboratory for revascularization. Coronary lesions were detected in 13 patients during angiography and revascularization was performed on 9 of them. Following ROSC, all patients transferred to the angiography laboratory were given aspirin before the procedure and 10 patients with STE were given clopidogrel 300 mg via nasogastric tube.

In 10 out of 15 patients with ROSC and ECG changes, STE, in 4 ST-T changes, and in 1 nodal rhythm was detected. Sub-analysis of 10 patients with STE revealed that 8 had lesions in one vessel, 1 had lesions in two vessels, and 1 had no lesion at all. The patient with no detected lesions was discharged healthy after a 12-day stay at the coronary intensive care unit.

According to the consensus of the the European Association for Percutaneous Interventions for patients with STE who have no significant possibility of coronary syndrome, but are hemodynamically unstable, emergency cardiac catheterization should be performed within the first 2 hours if possible (18). In all our 5 patients without STE, the interventions were performed within the first 2 hours. 3 of them had lesions in one vessel, 1 of them had lesions in 3 vessels, and 1 of them had no lesion at all. The patient without lesions declared exitus at the intensive care unit on the 41st day.

Fibrinolytic therapy might be another option in ROSC patients with STE, however, a small retrospective study revealed no significant differences in survival (19). If referral to a PCI center is not possible in a foreseeable time, in post-resuscitation patients with STEMI, acute fibrinolytic therapy might be an alternative reperfusion strategy option. In our clinic, all post-resuscitation patients had invasive treatment.

5. Conclusion

A significant relation between coronary intervention and survival was found in patients who were brought to the ED with CA and had STE on their ECG or had suspicious ACS history. Following ROSC, emergency physicians should consider the necessity of early invasive procedures in patients with STE or under high risk for ACS. Imaging and interventions performed in accordance with joint protocols of Emergency and Cardiology Departments may decrease mortality and morbidity.

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