Transportation of two patients with acute myocardial infarction for primary percutaneous coronary intervention by a helicopter ambulance

Akut miyokart enfarktüsü geçiren iki hastanın
primer perkütan koroner girişim için helikopter ambulans ile nakli

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Air ambulance system has been established throughout the country by the Ministry of Health of Turkey. Fifteen provinces are determined as centers of the system so that all the country is covered within at the most one-hour flight distance. As part of this nationwide system, two helicopter ambulances have been deployed in our hospital since November 2008. Prompt use of reperfusion therapy improves survival of patients sustaining acute myocardial infarction (AMI). Two components of delay from the onset of AMI to reperfusion therapy are prehospital and interhospital transportations. We presented the first two cases of AMI whose transfers were made by a helicopter ambulance for primary percutaneous coronary intervention. One patients (age 58 years, male) presented to a state hospital 47 km away from Ankara about an hour after the onset of chest pain. Time to reach the patients by a helicopter ambulance was 28 minutes and transfer to our center was 14 minutes. The other patient (age 76 years, male) was admitted within 15 minutes of the onset of chest pain to a state hospital 58 km away from Ankara. Reaching the patient by a helicopter ambulance and transferring him to our center took 30 minutes and 16 minutes, respectively. Door-to-balloon times were 16 minutes and 18 minutes, respectively. Infarct-related coronary artery patency was achieved in both cases.

Key words: Air ambulances; angioplasty, transluminal, percutaneous coronary; myocardial infarction; time factors; transportation of patients.

Ülkemizde Sağlık Bakanlığı tarafından helikopter hava ambulans sistemi kurulmuştur. Ülke genelinde merkez olarak belirlenen 15 ilden, birer saatlik uçuş mesafeleri ile tüm Türkiye bu sistemin kapsamına alınmıştır. Bu sisteme bağlı olarak hastanemizde Kasım 2008'den itibaren iki adet helikopter ambulans konuşlandırılmıştır. Akut miyokart enfarktüsü (AME) geçirmekte olan hastalarda reperfüzyon tedavisinin çabuk kullanımı ile yaşam kurtarılabilmektedir. Hastalığın başlangıcı ile reperfüzyon tedavisi arasındaki gecikmelerin nedenlerinden ikisi hastane öncesi ve hastaneler arası nakillerdir. Bu yazıda, AME geçiren ve hastanemize helikopter ambulans ile nakledilerek primer perkütanöz koroner girişim yapılan ilk iki olgu sunuldu. Olgulardan biri (58 yaşında erkek), göğüs ağrısı başladıktan yaklaşık bir saat sonra Ankara'ya 47 km uzaklıktaki bir devlet hastanesine başvurmuş, buradan 28 dakika sonra hava ambulansı ile alınarak 14 dakikada hastanemize getirilmiştir. Diğer olgu (76 yaşında erkek), göğüs ağrısından yaklaşık 15 dakika sonra Ankara'ya 58 km uzaklıktaki bir devlet hastanesine başvurmuş, buradan 30 dakika sonra hava ambulansı ile alınarak 16 dakikada hastanemize getirilmiştir. Hastanemizdeki kapı-balon süresi ilk olguda 16 dakika, ikinci olguda 18 dakika idi. Her iki hastada da enfarktla ilişkili arterde tam açıklık sağlandı.

Anahtar sözcükler: Air ambulances; angioplasty, transluminal, percutaneous coronary; myocardial infarction; time factors; transportation of patients.

Death events generally occur within the first hour following acute myocardial infarction (AMI). Time is a vital aspect for the treatment of fatal arrhythmias and the prompt use of reperfusion therapy for the damaged myocardium. Prompt use of reperfusion therapy is life saving for patients with MI. As a result, patients should be transported to the hospital as soon as possible. Two components of delay from the onset of the symptoms of AMI to reperfusion therapy are prehospital and interhospital transportations.[1] The use of air ambulances may shorten the time spent during the transportations of patients with MI to the hospital.

The air ambulance system has been in use in our hospital since November 2008. We presented two cases of AMI who were transferred by helicopter ambulance and who underwent primary percutaneous coronary intervention (PCI) for the purpose of investigating treatment approaches for MI and establishing the role of the air ambulance system.

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CASE REPORT

Case 1 – A 58-year-old male patient visited the Kazan District State Hospital, 47 km away from Ankara about an hour after the onset of chest pain. Time to reach the patient by a helicopter ambulance was 28 minutes and he was transferred to our center within 14 minutes. The patient presented with severe retrosternal chest pain and sweating. His physical examination demonstrated a blood pressure of 110/70 mmHg and regular pulse rate of 68/min. No murmur or additional heart sounds were heard during the cardiovascular examination. The patient did not have any cardiac risk factor except smoking. Electrocardiography revealed acute inferior MI findings. Coronary angiography also demonstrated a 100%, 80%, and 100% thrombotic occlusion in the left anterior descending (LAD) artery, circumflex (Cx) distal artery, and right coronary artery (RCA), respectively. Balloon angioplasty and stenting procedure were applied to the right coronary artery. The door-to-balloon time was 16 minutes in our center. As adjuvant pharmacotherapy, clopidogrel 600 mg loading dose and 75 mg/day maintenance dose were instituted. Unfractionated heparin 60 IU/kg IV bolus, tirofiban 10 Ìg/kg loading dose in 3 minutes and 0.15 Ìg/kg/min infusions were also instituted. The patient was given 300 mg chewable aspirin at the referring hospital. Complete patency was achieved in the infarct-related coronary artery. On the 3rd day of hospitalization, the patient was discharged without any complication.

Case 2 – A 76-year-old male patient visited the Ayas District State Hospital, 58 km away from Ankara about 15 minutes after the onset of chest pain. Reaching the patient by a helicopter ambulance and transferring him to our center took 16 minutes. The patient presented severe retrosternal chest pain. His physical examination showed a blood pressure of 120/60 mmHg and regular pulse rate of 72/min. No murmur or additional heart sounds were heard on auscultation. The patient did not report any cardiac risk factor in his medical history. Electrocardiography showed acute anterior MI findings, while coronary angiography revealed a 50% and 99% thrombotic occlusion in the RCA and LAD, respectively, and a circumflex artery with plaque. Balloon angioplasty and stenting procedure were applied in the left anterior descending artery. The door-to-balloon time was 18 minutes in our center. The patient was given adjuvant pharmacotherapy as in the first case. The patient was given 300 mg chewable aspirin in the referral hospital. Complete patency was achieved in the infarct-related coronary artery. On the 4th day of hospitalization, the patient was discharged without any complication.

DISCUSSION

Myocardial infarction is an important public health problem leading to death or advers influence on the quality of life. With the developments of coronary care units in the 1960s, intravenous fibrinolytic therapy and more aspirin use thereafter and development of PCI technique a decrease was observed in death events due to MI. However, the estimated mortality rate due to MI is thought to remain around 15% to 20%.[2] Prompt and appropriate use of reperfusion therapy within the first 24 hour following myocardial infarction is life saving. The mortality rate is lower in centers with a high number of patients and clinical interventions. On the other hand, the mortality rate is higher among patients who are not treated by cardiologists.[3] In randomized trials comparing percutaneous coronary intervention and fibrinolytic therapy, PCI was found to be less associated with mortality, recurrent MI, recurrent ischemia, target vessel revascularization and hemorrhage.[4,5] The benefits of percutaneous coronary intervention disappear when PCI is performed one hour after administering a fibrin-specific agent.

Current guidelines recommend a pre-hospital transportation time of <30 min, and a door-to-balloon time of <90 min.[6,7] In the ACC/AHA November 2008 statement on Performance Measurement and Reperfusion Therapy the entrance time -to-exit time in the referring hospital and the time lapse between entrance time to the referring hospital and PCI (first door-to-angiography time) for patients referred for PCI are also designated as criteria. It is also recommended that the time lapse till first use of device (balloon, stent, thrombectomy) (door-to-first device) should be measured in lieu of door-to-balloon time.[8] The DANAMI-2 and PRAGUE-2 trials found door-to-balloon time to be 26 minutes, while interhospital transportation was 32 min and 48 min for PCI, respectively. On the other hand, the interhospital transportation time is reported as 53 and 120 min, respectively according to the USA MI records.[9-11]

Based on the analyses, every 30-minute delay till the time of undergoing a PCI has been calculated to increase the yearly mortality relative risk by 8%.[12] It has been recommended that treatment systems for MI should be developed in order to initiate reperfusion therapy as soon as possible and to minimize the total ischemic time. In the Euro Heart Survey ACS II stated that 64% of the patients with MI have been reported to have undergone primary reperfusion therapy (PCI in 59%, and thrombolytic therapy in 41%).[13]

The European Society of Cardiology (ESC) also recommends the establishment of networks for reperfusion therapy, which include regional and national PCI facilities.[7]

Current guidelines recommend using PCI strategies in the treatment of MI; however this is not always possible, since there are a limited number of centers capable of performing PCI. Establishing PCI centers in most of the hospitals is also very costly. Therefore, it is reasonable to refer patients for PCI at centers specialized in the procedure.

Randomized trials have shown that transportation of the patients with MI for primary or life saving PCI is effective and safe.[9,10]

Air ambulances may significantly reduce the total ischemic time by decreasing transportation time, compared to land ambulance services. Another study has also shown that transportation of the patients by air ambulances is a safe practice for patients with acute MI.[14] Limitations of this system include dependence on environmental and meteorological conditions, absence of night vision systems and cautious use to control current leakage of the defibrillator.

Establishment of the air ambulance system throughout the country by the Turkish Ministry of Health has been initiated.[15] Provincial Ambulance Services affiliated to the chief physicians' control centers have been established in the provinces of Ankara, Istanbul, Erzurum, Izmir, Antalya, Kayseri, Diyarbakir, Canakkale, Adana, Afyon, Samsun, Trabzon, Konya, Bursa, and Van. All residential areas within a one-hour flight distance from these provinces are covered by the service (Figure 1).

Our hospital is a center with a high clinical capacity and numerous interventional procedures and with 24 hours and 7 days primary PCI facilities.. An average of 4800 diagnostic coronary angiography, 1900 PCI and 650 primary PCI for acute MI are performed annually.

In the air ambulance system two helicopter ambulances are constantly deployed in the hospital yard (Fi-

Figure 1. Air ambulance system centers and one-hour flight coverage areas being established by the Turkish Ministry of Health

gure 2). The distance between helipad and angiography laboratory on the ground floor is 50 meters. A physician and a paramedic trained for advanced life support are present in these air ambulances which are equipped with an ambulance monitor, defibrillator, oxygen, pulse oximeter, laryngeal mask, aspirator, and emergency cardiology medication. The first two patients who underwent primary PCI were referred to our hospital by 112 Emergency Service via telephone. The small hospital where patients from rural areas first visited did not have coronary intensive care units and cardiologists.

Although transportation of our first two patients by helicopter was safe, total ischemic time was not different compared to transportation by land ambulances. Total ischemic time was 128 min and 79 min, respectively and the interhospital transportation took 42 min and 46 min, respectively in helicopter ambulances. Transportation by a land ambulance could also have provided similar results. This suggests that MI treatment systems should be organized more appropriately.

In accordance with the guidelines, air ambulance system may be more efficient if the patient is to be transferred from a hospital with the capability of performing thrombolytic therapy or PCI is preferred to thrombolytic therapy and the patient visits the hospital within three hours after the onset of chest pain and if the transportation time would be decreased up to one hour by the air ambulance (transportation time limit)

AGUSTA 109 E   Maximum flight distance: 500 km
                    Number of personnel: 6 persons
                    Flight time: 140 min
                    Minimum speed: 166 knot

Figure 2. General outlook and technical characteristics of the ambulance helicopter used for transportation of patients with acute myocardial infarction for PCI

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compared to the land ambulance. If the patient presents with chest pain with an onset of >3 hours, PCI and as a result transportation by air ambulance may also be appropriate. An air ambulance may also be beneficial under conditions where transportation is performed from hospitals with no coronary care units and cardiologists, and also when the patient suffering from MI is to be transported directly to a center where PCI can be performed.

The agenda for the establishment of treatment systems for myocardial infarction have been brought up, since transportation time for primary PCI would be decreased.[16,17] These systems are expected to improve patient outcomes, through amendments which include emergency unit protocols requiring patients suffering from MI to be transported directly to centers where PCI can be performed or arrangements between emergency hospitals for interhospital transportations of the patients . The main objective of this system is to provide accurate diagnosis and transportation as soon as possible. Treatment programs for MI should include the following basic arrangements: (i) The emergency medicine specialist should be able to activate the system via telephone at the center where PCI is not available. (ii)The standardized protocol should be simple and systematic. (iii) The plan should be made regular for transfers from health centers where PCI is not available. An intensive training program should be organized for centers where PCI is not available, and this training program should cover emergency service call center, emergency service unit, primary health care providers and residents of the area. A quality development program should be enforced in this regard. (iv)The system should provide support for patients and their families during the period of hospitalization and returning home after discharge. Three programs can be given as examples for this system. Among these, The Reperfusion of Acute Myocardial Infarction in North Caroline Emergency Departments (RACE) and the Minneapolis Heart Institute's Level 1 Myocardial Infarction Program have been created to provide integration between hospitals where PCI cannot be performed and those which provide PCI services.[18,19] On the other hand, the Boston State Program involves creation of a protocols which allows transportation of the patients with MI directly to centers with PCI services. Further analysis is required to evaluate the effects of interhospital transportation on duration, cost and patient outcomes.

It is obvious that there is a need for both local and national treatment programs for MI in Turkey. As a result, we suggest that new projects should be developed by the related institutions and individuals.

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