

## **‘Platinum-Time’ Operation Measures to Reduce Traffic Fatalities**

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**Abstract:** There is a consensus that adequate trauma management for road casualties following the road crashes is a crucial element to reduce road fatalities. Trauma management consists of two parts, which are initial medical treatment by Emergency Medical Service (EMS) and further treatment by permanent medical facilities. Generally, golden hour, 1 hour after crash, is considered the time limit provided to relevant authorities for trauma management. The paper defines the time limit for EMS as Platinum-time, which means 20 minutes after crashes to realize golden hour in trauma management. It includes activities from reporting road crashes to transporting the casualties to a hospital. The paper describes five steps of EMS by reviewing Seoul Emergency Response System. Additionally, the paper suggests improvement to get Platinum-Time in technical and practical way to relevant authorities such as emergency technicians, police officers and medical center.

**Keywords:** Post-crash trauma, Trauma management, Emergency Medical Service, Platinum-ten, Golden hour

### **1. INTRODUCTION**

While the development of transportation has reduced travel time and enhanced daily lives, it also has resulted in road crashes, road fatalities and casualties. (Sul et al., 2014) South Korea is one of country showing high road fatalities among OECD member countries. South Korea showed 10.5 road fatalities per 10,000 people in 2012 and it was the second highest number after Poland. (Korea Road Traffic Authority, 2012) It indicates that the innovative efforts are needed to reduce road deaths and to improve road safety in Korea.

The possibility to reduce road fatalities is related to survivable injuries, which can be observed in step of post-crashes. It describes that adequate management for post-crash trauma should be developed to reduce road fatalities. Several studies revealed that 35 – 50 percent of road fatalities occur after road crashes in initial treatment at the scenes and further treatment at the hospital. (Hakkert et al., 2007) OECD (1999) shows the importance of adequate emergency service by comparing the survival rates in crashes between rural and urban areas. ETCS (1999) also highlights the role of management system for road casualties. According to research (Hakkert et al., 2007) 5 -10 percent of road fatalities can be defined as preventable road fatalities. In Korea, preventable road fatalities account for 32.6 percent of total road fatalities, which is over the level of OECD member countries. (Korea Road Traffic Authority, 2012) It implies the management system for road casualties in Korea should be reviewed and improved for road safety.

This management system is called as trauma management or post-crash care. It consists of two medical treatments, which are initial treatment provided by Emergency Medical Service (EMS) from the scene of road crash and transportation of casualties and further treatment at permanent medical center such as a hospital. Generally, trauma

management should be done within 1 hour after crash based on the concept of golden hour. The evidence that high survival rate of patient with medical treatment within golden hour highlight the importance of time limit in trauma management. (Lee, 2007) However, Realizing golden time in trauma management is not easy. This is because trauma management is a changeable according to severity of road crashes. Especially, there is a limitation to reduce the period of medical treatment at the permanent medical center. Therefore the operation of EMS is responsible for rapid and adequate trauma management by cutting unnecessary delay. Several studies about EMS verified that EMS response time is related to reduction of road fatality rates. (Brodsky, 1993; Maio et al., 1995; Henriksson et al., 2001)

This paper defines the time limit for EMS to realize golden hour in trauma management by literature review. Seoul Emergency Response System is reviewed based on time limit to identify the problems cause the delay in trauma management. In this section, five steps for EMS are defined. Improvements are suggested in practical ways for all relevant authorities including emergency technicians, police officers and medical team in medical center. This paper helps to provide the direction of research and technical development to improve EMS and road safety in Korea.

## **2. GOLDENT HOUR AND PLATINUM TIME**

Golden hour is a major concept in trauma management for casualties after road crashes. To increase the survival rate of severe road traffic injuries, necessary medical treatment at the scene and permanent center should be done within 1 hour in accordance with the concept of golden hour. The time sequence steps of trauma management are summarized in Figure 1. Step 1 – 9 should be done within golden hour. Relevant authorities such as emergency technician and medical team should be involved in step 4-9. Step 6-9, medical treatment in a hospital, takes large parts of time limit. Thus the speed of trauma management depends on the effectiveness of EMS consisting of activities from step 3 to 5.

As the golden hour does not describe specific activities for trauma management, there have been some trials to break down the golden hour by activities. Platinum-ten is the one of them, which means 10 minutes for medical treatment. It describes that emergency medical treatment at the scene and hospital should be done within 10 minutes to increase survival rate of patients. Thus 10 minutes should be assigned the each step of medical treatment in trauma management. Except for initial treatment, medical treatment belongs to further management in permanent center after transportation of patients. This medical treatment conducted by nurse, emergency medicine physicians and anesthesiologist and the surgeon, respectively. Considering the platinum ten, these activities require 40 minutes among golden hour. It remains 20 minutes for EMS. Therefore this paper defines the 20 minutes as time limit for EMS and called as Platinum-Time

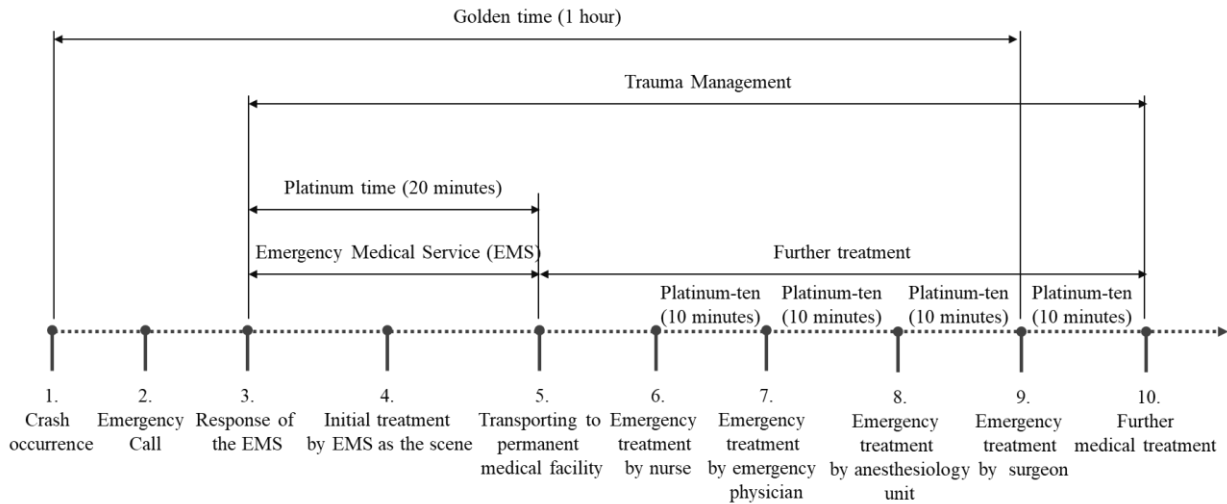


Figure 1. Steps of trauma management

### 3. CASES OF EMERGENCY MEDICAL SERVICE

#### 3.1 Japan

Doctor Car System is EMS in Japan to communicate the emergency technicians and medical team at a hospital. Doctor can be transported to scene with request of fire station by emergency vehicles including ambulance from fire stations and medical institutions. The specific steps are below.

1. The patients' condition is reported to fire station.
2. When patients are seriously injured and transporting to medical center might be dangerous, an ambulance with doctor for initial treatment is sending as a Doctor Car.
3. Under the responsibility of doctor, Doctor Car provides the professional emergency while the patient is transporting to the medical center.

The objective of Doctor Car System is to allow a doctor to arrive at the site as early as possible. It is for preventing the patient's condition from worsening during transportation. It is provided by Trauma and Resuscitation Center around the clock and including the Doctor Heli System, which is a similar service using helicopter. (Ashikaga Red Cross Hospital)

#### 3.2 United State

Emergency Medical Technician System is two-tier service including professional operator services and Emergency Medical Technician (EMT) Service. Professional operators are responsible for initial treatment before Emergency medical Technicians arrived. Emergency Medical Technicians are sent with appropriate facilities. They are responsible for additional measure and transportation of patients to medical centers through the communication of doctors. Doctors decide the cords which indicate the severity. Each step is below.

1. 911 center receives the record of road crash and sends professional operator for initial treatment under doctor's direction. (National Fire Service Academy, 2009).
2. Based on severity, the level of EMTs, Basic Life Supporting units (BLS) or Advanced Life Supporting units(ALS), are decided and sent
3. EMTs take the appropriate steps using communication system to doctors. Doctors decided the cords of EMT system, which are EMT-Basic, EMT-Intermediate and EMT-Paramedic. During transportation of patient, the hospital or medical center are

ready for taking professional medical treatment based on these codes.

The code must be decided when initial treatment is not given directly by doctors. This system helps the seriously injured casualties to get appropriate measures promptly under the responsibility of professional doctor and the medical center to distribute the resources effectively.

### **3.3 France**

France has a two-tiered system including a firefighting first-aid system and SAMU (Service d'Aide Médicale Urgente) as EMS. A total of 105 SAMUs are in operation depending on the administrative districts. This system aims to report the severity to permanent medical center rapidly. A team consists of three emergency technicians and a doctor. Specific steps are below.

1. When a road crash occurred, SMURs arrive within 15 minutes after reporting.
2. SMUR are responsible for initial treatment at the scene and transportation of patients
3. SMUR decides the severity of road crash. According to severity, they could request transporting service for minor accidents or emergency medical service for severe road traffic injuries.
4. The patients are transported within 20 minutes after initial treatment. (National Emergency Medical Center, 2005)

## **4. REVIEW OF SEOUL EMERGENCY RESPONSE SYSTEM**

### **4.1 5 steps of Seoul Emergency Response System**

This paper reviews the Seoul Emergency Response System which is introduced in 2013. Emergency technicians, police and medical team take part in trauma management. Emergency technicians from Fire and disaster department are responsible to rescue and initial treatment by using emergency vehicles. Police officers are responsible for management of scene including traffic control. Hospitals dispatch the emergency vehicles such as ambulances following the request from emergency technicians. Seoul Emergency Response System consists of five steps which are identification of road crashes, information share, Access to the scene, initial treatment and transportation to permanent medical center. The each detail of step is below.

#### ***Step 1: Identification of road crashes***

Road crashes are reported to Emergency call center by a direct call.

#### ***Step 2: Information Share***

The detail of road crashes is shared between police officers and emergency technicians. According to the severity of records, the level of emergency technicians is decided. When serious injured casualties are guessed, Class I technicians consisting of high-qualified technicians are selected. Emergency technicians can request the ambulance from hospitals. Police officer can confirm the condition of scene by using CCTV on the road but this information from CCTV is not shared between authorities.

#### ***Step 3: Access to the Scene of Road Crash***

Emergency technicians are sent to scene by using emergency vehicles. Police officers can support the emergency vehicle. Seoul Emergency Response System also operates the fire

helicopters in case of the problem of accessibility to the scene caused by traffic jam.

#### ***Step 4: Initial medical treatment***

Emergency technicians provide initial medical treatments before transporting to permanent medical center.

#### ***Step 5: Transportation to permanent medical center***

Road casualties are transported to medical center for further medical treatment. Emergency technicians report the condition of patients to medical team before they arrive. Medical team must be ready for taking rapid and adequate treatment as soon as possible.

### **4.2 problem of Seoul Emergency Medical Service**

The paper reviews the steps of Seoul Emergency Response System and reveals the points that may cause the delay in trauma management. In step 1, dependent to direct call for identification of road crashes can make delay when all parties to road crashes are unconscious. It is also not reliable to depend on call by surrounding people. Seoul Emergency Response System should supplement the system to detect the road crashes.

In step 2 and step 3, the absence of shared information management system between relevant authorities makes it difficult to quick response. As police do not share the information gotten by CCTV, emergency technicians and medical team depends on limited information from records. It leads to unsuitable medical services in step 4 and step 5. Moreover, it can make a delay in transporting process to limit restrain traffic information.

In addition, there should be communication system between emergency technicians and medical teams to prepare the further treatment in step 5. Effective communication system between them helps to share the information and support rapid and adequate treatment to patients leading high survival rate.

## **5. IMPROVEMENT OF SEOUL EMERGENCY MEDICAL SERVICES**

### **5.1 Development detection system for road crashes.**

As the detection of road crashes in Seoul Emergency Response System depends on only direct call, automatic detection system should be introduced to cut response time. Detection system by noise and shock can be adopted. Several European countries already adopted Emergency Call or Emergency SOS system between individual vehicles and call center, which are detecting abnormal wave of airbag. When it is detected, an emergency message from individual vehicle is sent to regional emergency center. Furthermore, CCTV Control Service for Abnormal Sounds (2014) can be installed. It detects the specific sound from road crashes. Unlike normal CCTV detection, it is not affected by weather such as fog or darkness.

### **5.2 Shared Information System between Authorities**

Shared information system should be developed between all parties in trauma management. In Korea, all parties mean emergency technicians, police officers and medical team in hospital. Shared information system should provide information from CCTV including the image of scene and traffic information. It can be used to decide the severity in advance of initial treatment and find optimal route to cut access time of emergency vehicles.

### **5.3 Emergency Vehicle Signal Priority**

While access to scene is a crucial part to shorten emergency response time, there is no way to

grantee the movement of emergency vehicles in Seoul. Under the cooperation with police officer, emergency vehicle signal priority in crossroad can be adopted. It can increase the speed of emergency vehicles and reduce the delay in crossroad. Reserved lane for emergency vehicle can be applied to with it.

#### **5.4 Patient Distributing System**

According to the statistics in 2012, 74 percent of patients were transported to hospital by their family's decision without considering severity and distance. It can cause the delay of emergency care. (Lee, 2004) Hence, a system to distribute casualties considering urgency should be adopted. In addition, communications between an ambulance and a hospital should be effective during transporting casualties. The methods by voice call can be missed according to condition of medical team. Thus, major information such as severity should be sent to hospital as the text format to help them prepare the medical care and facilities. Visual information including departure, arrival time, the type of an accident, and the condition of a patient can be sent as reference.

### **6. CONCLUSION AND FURTHER STUDIES**

This study proposes five steps for Emergency Medical Service and reviews the Seoul Emergency Response System to find the problem may cause the delay. To realize golden hour for trauma management, this paper defines Platinum time for EMS, which is 20 minutes from reporting road crashes to transporting to hospital. This paper finds the problem of Seoul Emergency Response System in each step.

High dependency on direct call of reporting road crash can make delay in step 1, which is identification of road crashes. It's not reliable method considering the case of that all parties to road crashes are unconscious. The call by surrounding people is also not solid. Seoul Emergency Response System should supplement the system to detect road crashes. In step 2 and step 3, the absence of shared information management system between relevant authorities makes it difficult to quick response. Because police officers monopolize traffic and road crash information by CCTV, emergency technicians and medical team use limited information gotten by direct call in reporting system. It lets them to prepare unsuitable medical services in step 4 and step 5. Moreover, it can make it is difficult that emergency vehicle finds the optimal routes. In addition, insufficient communication between emergency technicians and medical team can result in delay.

The paper provides improvement methods for Seoul Emergency Response System in a practical way. Road crash detection system, shared information system, emergency vehicle signal priority and patient distribution system are recommended as options. Road crash detection system using wave and sound from vehicles in road crash can cut the time for identifying road crashes. Shared information system between authorities can support the decision of emergency technicians at the scene and medical team in permanent medical center. Step 2, Information share, highlights the need of sharing visual information and traffic information from CCTVs. Emergency vehicle signal priority can support the rapid movement of emergency vehicles in step 3, which is assess to the scene of road crash. Patient distributing system can be applied to step 5, which is the period to transport to permanent medical center. As most of patients in Seoul are distributed regardless of severity, the effective distributing method by communication between emergency technicians and hospital can reduce the transporting time and help rapid and adequate medical treatment in permanent medical center.

Local governments should develop an emergency medical system to reduce road

fatalities in Korea. As the survival rate of serious injured casualties in road crash depends on time management, regional service and center play an important role to save the victims in road crashes. Cooperation with competent authorities, development of relevant technologies, and improvement of the legal system is necessary to improve road safety and protect daily lives.

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