Addressing issues associated with prehospital emergency transportation

1. Background and goals

We all take advantage of the 119 emergency ambulance services in the event of unexpected injury or acute illness. In Tokyo, it takes as much as 6 min 38 sec on average (as of 2012) for an ambulance to arrive on scene after mobilization. Moreover, on-scene time continues to increase every year, potentially delaying treatment of high acuity illness, such as cardiovascular diseases and stroke, and causing permanent damage or serious complications. These issues may turn rescue activities that would have saved lives into fatalities.

Although various factors, including patient- and community-specific factors and changes in social structures, are involved in prolonging on-scene time, no previous study has examined the entire range of factors at once, making it difficult to address the problem. Cities that provide broad-based critical care activities in densely populated areas, such as the Tokyo and Osaka metropolitan areas, are likely to face problems associated with longer emergency service time, whereas Fukuoka City and other smaller cities tend to provide critical care activities smoothly within a given area.

The aims of this study are (1) to reveal issues associated with prehospital ambulance transportation by using objective floating car data on ambulance transportation to develop effective measures and (2) to investigate the case where injured or diseased patients are transported from hospital to hospital due to each one refusing to accept them by comparing differences in emergency care services between cities with and without such problems. Findings from these studies will allow us to recommend solutions to performing effective prehospital critical care activities in much broader areas in the future.

2. Research content

2-1. Comparisons of critical care activities among cities of different sizes

To reveal the differences in critical care activities among cities of different sizes, we analyzed actual care activities provided in Tokyo , Fukuoka City, Fukuoka Prefecture, and Kamagaya City, Chiba Prefecture (Fig. 1). Although the size of Fukuoka City is somewhere between that of Tokyo and Kamagaya City, individual emergency response teams in Fukuoka City are responsible for a larger population and a wider area. Travel time between dispatch and arrival on scene was shortest with Kamagaya City. However, Fukuoka City had the shortest on-scene time, which was 6 min 25 sec shorter than on-scene time

Project Leader: Takashi Moriya
Professor, Emergency Department, Saitama Medical Center, Jichi Medical University

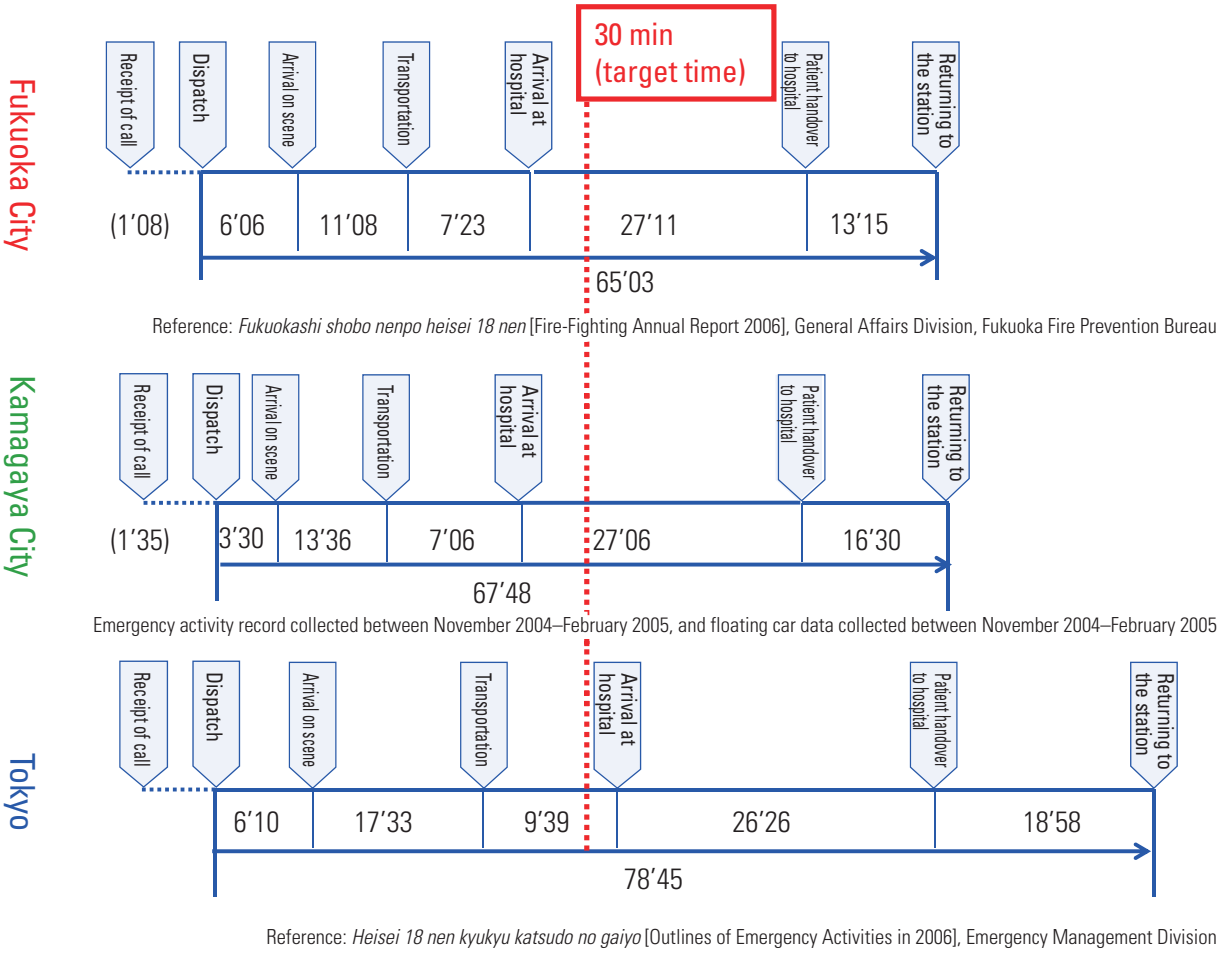


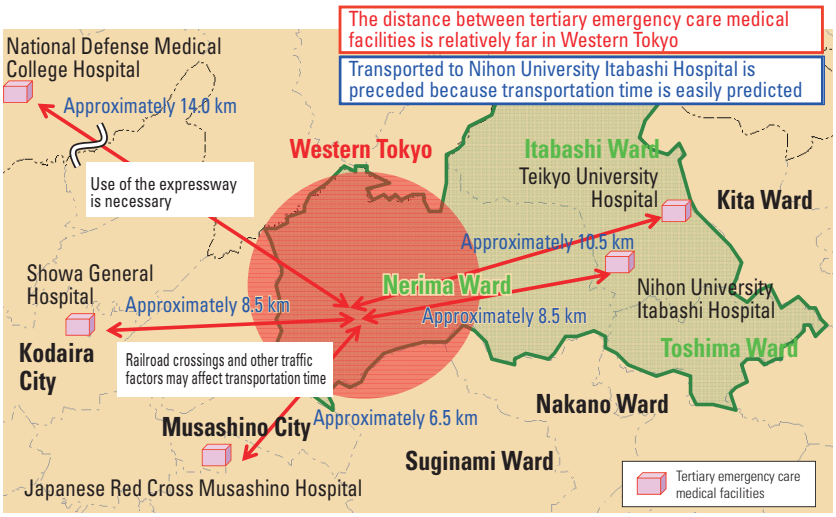
Figure 1. Comparisons of current critical care activities provided in Fukuoka City, Kamagaya City, and Tokyo
The target time between dispatch and arrival at hospital is 30 min.

required in Tokyo. Tokyo also had the longest transportation time.

2-2. Current situations in critical care activity provided to high acuity patients during transportation

Analysis of emergency care service data collected at the Critical Care Center of Nihon University Itabashi Hospital,[(1)] Tokyo, revealed that (1) transportation time is excessively long in certain areas, (2) rapid transportation is prevented by narrow streets and railroad crossings where gates remain lowered for an extended time, and (3) there are only a small number of secondary emergency care facilities equipped and designated for providing care to moderate acuity patients in Tokyo. This results in patients having to be transported to tertiary emergency care medical facilities, which provide care to high acuity patients requiring admission to an intensive care unit, because their conditions deteriorated while the

(1) The Critical Care Center of Nihon University Itabashi Hospital is a tertiary emergency care facility for treating patients facing critical situations. Patients in less serious condition, but who still require inpatient treatment or emergency surgery, are treated at secondary emergency care medical facilities.



The distance to a tertiary emergency care facility is a straight distance from Shakujii Park, which is located almost mid-way between the Oizumi and Shakujii districts.

Figure 2. Problems associated with the area covered by individual tertiary emergency care medical facilities

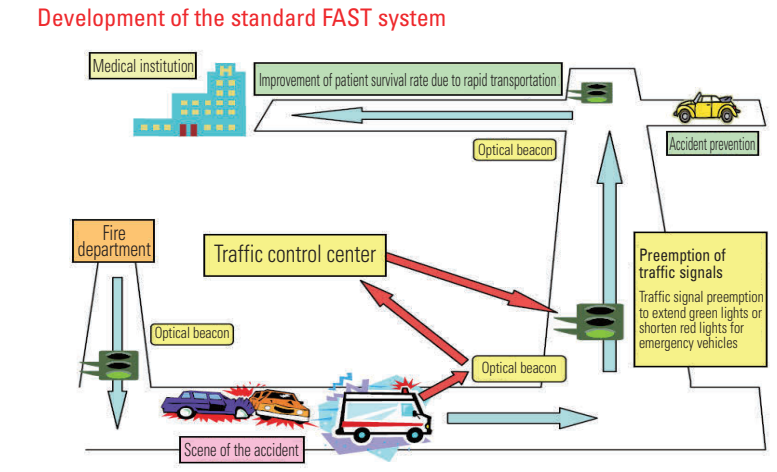
emergency response teams were traveling from hospital to hospital in search of an appropriate destination (Fig. 2).

2-3. Example of cities that operate a smooth emergency care system

In contrast, some cities provide efficient emergency care services. For example, Fukuoka City utilizes a Global Positioning System to locate an emergency response team, which displays the address to shorten the time to locate the scene, utilizes information on traffic and hospitals' preparedness to accept emergency patients, and relocates emergency response teams if they are unevenly distributed in a given area to reduce travel time, on-scene time, and transportation time.

Kanazawa City has incorporated a traffic signal preemption system for emergency vehicles (Fast Emergency Vehicle Preemption System (FAST)) to streamline the city's emergency services (Fig. 3). In the areas where the FAST system is in place, the speed of emergency vehicles has been improved, travel and transportation time has been shortened, and the emergency service area covered by each response team has been expanded.

FAST: a system used to control traffic signals to prioritize an approaching ambulance and other emergency vehicles and to prevent traffic accidents involving those vehicles at intersections.



Reference: *Shobo no ugoki* [Current Developments in Fire and Disaster Management], No. 440, Fire and Disaster Management Agency, November 2007

Figure 3. Fast Emergency Vehicle Preemption Systems (FAST) in Kanazawa City

3. Conclusions

A close association between fire departments, on-scene emergency response teams, and hospitals is the key to proper critical care activities. To improve the rate of life-saving emergency services, it is of paramount importance to shorten and tighten the links between the three divisions in the critical care triangle (Fig. 4). This can be achieved by shortening time for travel, on-scene prehospital care, and transportation. In search of solutions, we investigated the current situations and challenges of critical care activities provided in three cities.

The findings of this study showed that the time required to locate the scene and to arrive on scene can be effectively shortened by the establishment of a proper emergency management system or by the incorporation of FAST, and that emergency transport time can be reduced by appropriately placing regional secondary emergency medical facilities. Successful critical care activities cannot be achieved only by establishing information systems or by streamlining emergency hospitals. It is important to develop a critical care system that is appropriate for the size of each community to build close working relationships and foster highly sophisticated collaboration between emergency management centers, emergency response teams, and physicians.

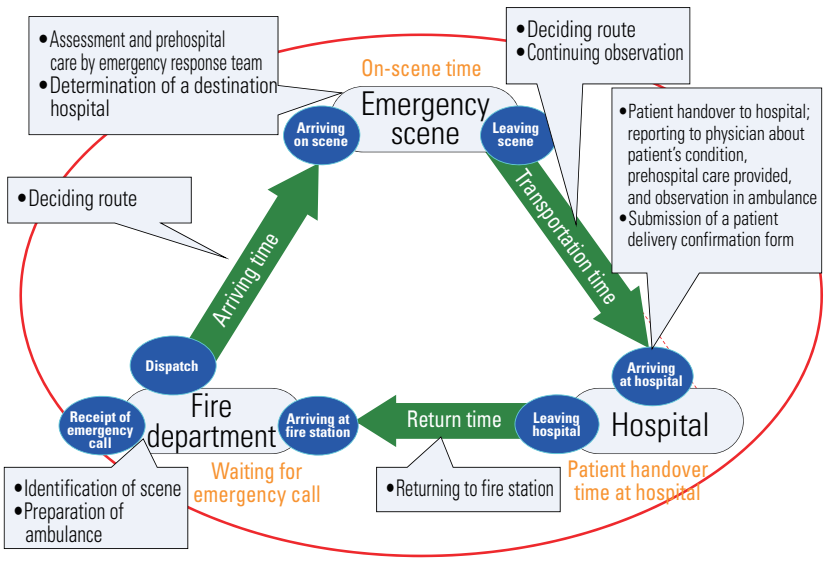


Figure 4. Critical care triangle

Issues that need to be addressed include the incorporation of the command and control system, the investigation of effective wide-based emergency services, and the determination of how the FAST system would improve emergency transportation. Furthermore, it is important to develop measures in the event of hospitals' refusal to accept emergency patients in order to improve hospital acceptance rates.

4. Future outlook

The prolongation of time required for emergency care response and transportation is a serious problem even in local cities. On-scene time is also anticipated to increase due to the expansion of prehospital care. It is therefore important to establish an effective multidisciplinary cooperation system between physicians, nurses, administrators, the police, the fire department, emergency services, and the government.