ORIGINAL RESEARCH

Development of an Educational Program for the Helicopter Emergency Medical Services in Japan

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Abstract

Introduction: The Japanese helicopter emergency medical service (HEMS) system provides advanced prehospital treatment at the scene. The education of the dispatched HEMS physicians is important for guaranteeing the quality of medical and safety management, but there is no nationally established training program. This study aimed to determine the validity of the HEMS educational program developed by our team.

Methods: A 3-step educational program was designed for HEMS trainees: step 1, 20 HEMS missions as an observer; step 2, 80 missions of on-the-job training; and step 3, certifying examination conducted by a supervisor. As an evaluation standard, scene time, defined as time from landing at the scene to taking off for a hospital, was determined retrospectively.

Results: For trainees, scene time was significantly longer (16.3 ± 5.4 min, 95% CI 15.5-17.1) than for experts (doctors who completed >200 HEMS missions; 15.2 ± 6.7 min, 95% CI 14.7-15.8; $P = 0.040$) but was significantly shorter than for doctors trained before establishment of the HEMS program (17.5 ± 7.0 min, 95% CI 16.9-18.2; $P = 0.030$). In cases of trauma or intrinsic disease, there was no significant difference in scene time between trainees (17.4 ± 5.6 min and 14.9 ± 4.8 min, respectively) and experts (16.4 ± 7.8 min and 14.2 ± 5.5 min, respectively).

Conclusion: The finding that scene time was shortened for program trainees demonstrates the validity of our HEMS educational program. The quality of HEMS missions will be better ensured through this educational system.

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Introduction

Under the direction of the Japanese Ministry of Health, Labour and Welfare, since 2001 a helicopter emergency medical service (HEMS) system, the so-called "doctor-helicopter" system, has been developed as a national project. This system provides "onsite emergency department capability" such as advanced prehospital treatment by trauma surgeons or emergency physicians at the scene. It is now firmly established as part of the emergency medical services (EMS) system in daily use in Japan. However, there is no established training program for doctors who work from rotorcrafts.

Although the education of the trauma surgeons and emergency physicians dispatched is clearly an important issue in ensuring the quality of medical and safety management in prehospital care, few reports have investigated the education required for medical crews working in an HEMS system.[1-3] The objective of this study was to examine our own HEMS educational program and determine its validity.

Materials and Methods

The Hokusoh HEMS

The Hokusoh HEMS was established in October 2001 at the base hospital of Chiba Hokusoh Hospital, Nippon Medical School. We cover the eastern Kanto area, which is north of Chiba Prefecture and south of Ibaraki Prefecture (Figure 1). The annual number of HEMS missions performed is increasing, and a total of 6,425 missions were completed between October 2001 and September 2011.

Preliminary Study

Before developing our HEMS educational program, the performance of 10 doctors was examined. The doctors were divided into 2 groups based on their professional experience between April 2006 and March 2009: 5 doctors were classified as experts (ie, having experience of > 300 HEMS missions) and 5 doctors as rookies (ie, having experience of < 200 HEMS missions).

This preliminary study sought to evaluate and compare "scene time," which was used as an evaluation standard, for the 2 groups. Scene time was defined as the time from landing at the site of the accident or at a temporary heliport to the time of takeoff for a hospital (excluding interhospital transportation and accidents involving multiple

Figure 1. The area covered by the Hokusoh HEMS.

victims). Patient characteristics and interventions performed by the HEMS physicians were evaluated from the flight and medical records. Data are expressed as the mean ± standard deviation. Because scene time did not have homogeneity of variance according to the Kolmogorov-Smirnov test, the Wilcoxon signed rank test was used for statistical analysis, and the chi-square test was used for categoric data. A P value $< .05$ was considered to be statistically significant.

It was found that scene time was significantly longer for rookies with < 90 HEMS missions (17.5 ± 7.0 minutes; 95% confidence interval [CI], 16.9-18.2; $P < .001$) and > 90 HEMS missions (16.5 ± 6.5 minutes; 95% CI, 15.9-17.1; $P = .003$) than for experts (15.2 ± 6.7 minutes; 95% CI, 14.7-15.8; Figure 2, available online). For trauma cases, scene time was significantly longer for rookies with > 90 missions than for experts (17.8 ± 7.4 vs. 16.4 ± 7.8 minutes, $P = .040$), but for cases of intrinsic disease (eg, acute coronary syndrome, cerebrovascular disease, respiratory disease, and so on), there was no significant difference between the 2 groups (15.2 ± 5.1 vs. 14.2 ± 5.5 minutes, $P = .064$).

HEMS Training Program

On the basis of these preliminary findings, we designed a 3-step educational program for recruited HEMS staff (Figure 3). The physicians working in this program are divided into 3 categories: "instructors" who have completed > 300 HEMS missions, "seniors" who have completed 100 to 300 HEMS missions, and "trainees" with experience of < 100 HEMS missions.

For step 1, the trainee is required to board the helicopter 20 times as an observer under the supervision of an instructor or senior and is allowed to practice only simple treatments at the scene. Through step 1, the trainee learns an outline of the HEMS system, medical interventions at the scene, and the relationship between medical staffs and all concerned.

For step 2, the trainee is required to complete on-the-job training under an instructor's or senior's supervision for 80 HEMS missions and should treat patients and direct other personnel (eg, emergency medical technicians and firefighters) at the scene. The trainee has to manage all of the HEMS activity in an educational case. The instructor or senior gives to the trainee some guidance about their performance of each HEMS mission according to our evaluation form at the debriefing (Table 1, available online). During steps 1 and 2, the trainee can drill case scenarios using a mannequin to complement the actual HEMS mission as an off-the-job training.

For step 3, after involvement in 100 HEMS missions in total, the trainee's performance is evaluated on 3 or 4 HEMS missions by 2 instructors according to the objective criteria (Table 2, available online). Occasionally, flight nurse's comments may be referred for evaluation. After passing the evaluation, the trainee is allowed to be dispatched to the scene independently as a senior.

Data Collection and Analysis

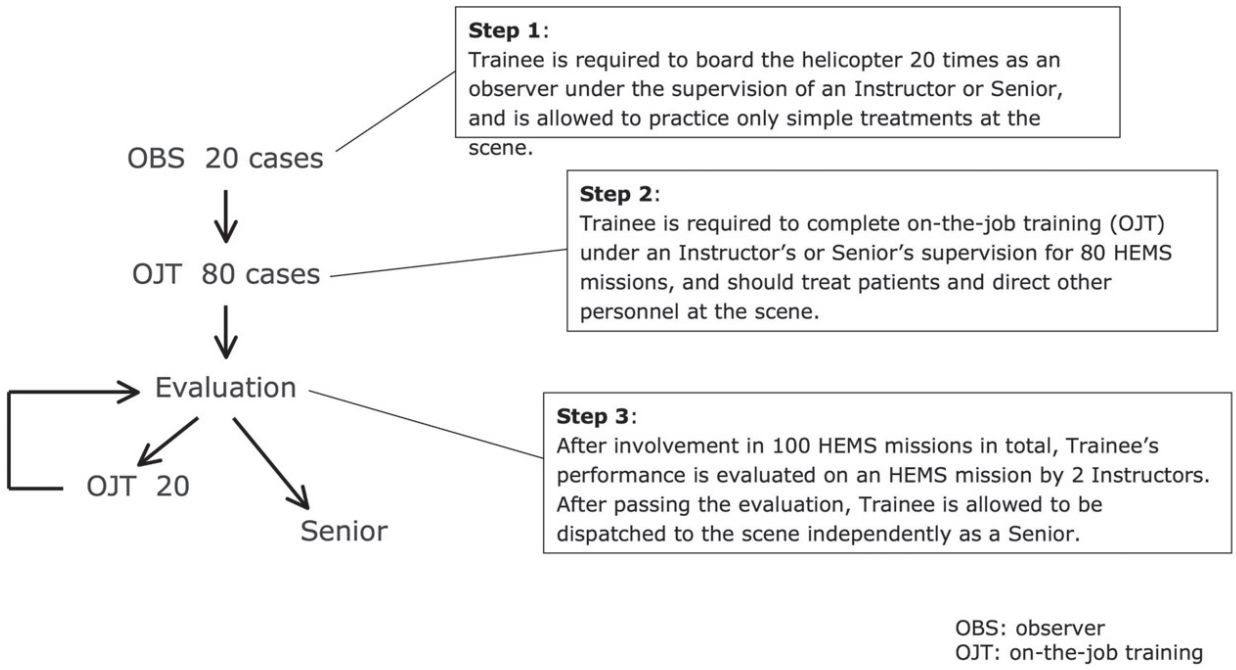
To evaluate the validity of our educational program, scene time was compared for the following groups: the trainee group (5 doctors with experience of 100 HEMS missions) who were working through the designed educational program, expert group (5 doctors with > 300 missions), and the rookie group (5 doctors with < 90 missions) from the preliminary study before the development of the educational program. The definition of scene time, the method of data collection of patient characteristics and interventions performed at the scene, and the method of statistical analysis were the same as those used in the preliminary study.

Results

Since starting the educational program in April 2009, 5 trainees have passed this step-by-step program, and 2 trainees dropped out for individual reasons unrelated to the program. It takes approximately 10 months to complete the program. Patient characteristics, the time required negotiating with the hospital for patient transportation, and interventions performed for patients at the scene (eg, fluid administration, tracheal intubation, tube thoracostomy, and emergency thoracotomy) did not significantly differ between the 3 physician groups (Table 3, available online).

For trainees, scene time was significantly longer (16.3 ± 5.4 minutes; 95% CI, 15.5-17.1) than for experts (15.2 ± 6.7 minutes; 95% CI, 14.7-15.8; $P = .040$) but was significantly shorter

Figure 3. The HEMS Training Program.



than for rookies who had not worked through the educational program (17.5 ± 7.0 minutes; 95% CI, 16.9-18.2; $P = .030$; Figure 4, available online). In regard to handling cases of trauma or intrinsic disease, there was no significant difference between trainees (17.4 ± 5.6 minutes; 95% CI, 16.3-18.4 and 14.9 ± 4.8 minutes; 95% CI, 13.8-16.0, respectively) and experts (16.4 ± 7.8 minutes; 95% CI, 15.2-16.9 and 14.2 ± 5.5 minutes; 95% CI, 13.5-14.9, respectively; Figure 5, available online).

Discussion

Under the national project for developing an EMS system, the Ministry of Health, Labour and Welfare has developed a Japanese HEMS system, the so-called "doctor-helicopter" system, modeled on the ADAC in Germany, the REGA in Switzerland, and the London HEMS in the United Kingdom.[4-7] Since its establishment in 2001, HEMS bases have been expanded at 27 sites across the country; however, this has not yet reached half the coverage needed nationwide.

The HEMS system operating out of our base hospital provides an advanced prehospital treatment for the severely ill or injured. The system is alerted through a direct telephone call from EMS providers at the scene or from the fire department's dispatch center. Our flight crews include 2 trauma surgeons or emergency physicians and 1 flight nurse. The helicopter is able to launch within 3 minutes from receiving the dispatch call because of the quick start of the rotor wing and rushing to the helipad of medical crews. The helicopter lands at the designated temporary heliport nearest the accident scene (eg, a park, schoolyard, or athletics field). An ambulance car transports the patient to the temporary heliport from the scene, and medical intervention is performed in the ambulance car. Occasionally, medical crews go to the site of the accident or the helicopter lands directly near the scene. From there, the patient is transported to the emergency department of the receiving hospital by rotorcraft or ambulance car.

The efficacy of the "doctor-helicopter" system has been investigated.[8-10] In 1 study, it was found that the revised trauma score calculated from the physiologic parameters on emergency department arrival was improved when comparing the revised trauma score in the prehospital setting for severe trauma patients.[8] Generally, HEMS doctors dispatched to the scene have to perform procedures such as an airway management including a cricothyroidotomy, drug administration, ultrasonographic examination, and a tube thoracostomy. Sometimes we attempt an aggressive surgical treatment, such as an emergency thoracotomy for severe trauma patients.[9] Clearly, these interventions should be performed by appropriately experienced, trained, and equipped doctors who can provide quality-assured medical care.

Before designing and implementing our HEMS educational program, our education of the HEMS staff was not formalized or controlled. We dispatched young physicians to the scene who were not systematically educated for such a role. Rather, they had acquired knowledge and safety management and leadership skills by treating many patients in the emergency department. A new physician at our institute was permitted to board the helicopter independently after they were deemed to be able to handle such cases in the emergency department. However, this "happy-go-lucky" approach did not guarantee quality performance at the scene, which highlighted an important (and long-standing) problem concerning quality assurance of their HEMS activity. Against this background, since 2009, our Hokusoh HEMS has been in the process of developing an educational program for our HEMS physicians.

Rookies who learned about HEMS missions through the unplanned approach could not reach the expert level in the preliminary study; in particular, even scene time for rookies who had > 90 missions was longer than that for experts in trauma cases. However, scene time for trainees who completed our program was almost equal to that for experts in both trauma and intrinsic disease cases. Although a statistically significant difference in scene time of around 1 minute shorter was shown, it might make little difference clinically. However, although this reduction in scene time and the small standard deviation of scene time for trainees show immediate advantages of this educational program, it suggests that the introduction of the system has improved HEMS activity in a uniform manner. Moreover, HEMS physicians must not only have the skills to treat patients properly but also to act as leaders at often confused scenes and undertake crew resource management. Our rookies are also able to learn leadership skills to help unify the response and ensure safety through on-the-job training.

There is an obvious difference between US and European countries (eg, United Kingdom and Germany) with regard to physicians boarding on the aircraft. As mentioned previously, the Japanese HEMS system was modeled on the European style; therefore, our evaluation form and objective criteria were structured based on the checklist of the London HEMS.[1] Although we referred also to Commission on Accreditation of Medical Transport System (CAMTS) accreditation standards, our criteria did not need as detailed a standard as CAMTS in our first process of program development. However, we have to establish the accreditation standards for our program according to CAMTS in future.

A large volume of cases is required for HEMS. Our trainees have taken approximately 10 months to complete the program because our rotorcraft (McDonnell Douglas MD902 Explorer) has only 1 seat for a trainee. Naturally, if we were to use another helicopter (eg, Eurocopter EC145) that provides seats for more than 1 trainee, then we could offer more on-the-job training, but this is not a realistic solution. To compensate for an insufficient number of dispatches to the scene, Bredmose et al[1] used scenario-based training with a simple mannequin. A few simulation trainings were once held to practice the activity in the cabin for rookies with carrying the simulator on the helicopter, but it was not useful to train and evaluate rookies' performance concerning a total HEMS mission. Therefore, we have introduced scenario training to learn motor skills, critical decision making, scene management, and team interaction with an intubatable and vital signs (eg, heart rate, respiratory rate, blood pressure, oxygen saturation, and so on)–expressible mannequin, which is conducted in the ambulance car.

The limitation of this study is that the evaluation standard used was only that of scene time. Because scene time includes the time required to examine the patient, to perform any intervention, and to contact the receiving hospital about transporting the patient, we consider that this "stay and play" time at the scene can reflect the quality of the various HEMS activities undertaken. However, our evaluation criteria were determined based on our own experiences and have not been standardized in Japan. The need for various evaluation criteria and their standardization and validity are topics for future discussion.

Conclusion

The fact that scene time was shortened for trainees of our HEMS educational program shows the validity of the program. The quality of our HEMS missions will be ensured better through this educational system, which provides training on-the-job over time. It is expected that our educational program will be useful for further development of Japan's HEMS system.

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