SAS Journal of Medicine ISSN 2454-5112
SAS J. Med., Volume-2; Issue-5 (Sep-Oct, 2016); p-110-114
Available online at http://sassociety.com/sasjm/

Original Research Article

An evaluation of a mass casualty life support course for chemical, biological, radiological, nuclear, and explosive incidents

Youichi Yanagawa* MD. PhD., Hideaki Anan[1], MD. PhD., Kenichi Oshiro[2] MD. PhD., Yasuhiro Otomo[3], MD., PhD.
*Shizuoka Hospital, Juntendo University, Japan
[1]Fujisawa City Hospital, Japan
[2]Kawasaki Municipal Hospital, Japan
[3]Tokyo Medical and Dental University, Japan

***Corresponding author**
Youichi Yanagawa
Email: yyanaga@juntendo.ac.jp

Abstract: The management of mass casualties induced by chemical, biological, radiological, nuclear and explosive incident (MCLS-CBRNE) and terrorist events requires special preparation to ensure safety and communication. This report introduces the first educational program targeting CBRNE incidents to be established in Japan that targets first responder. The MCLS-CBRNE contains four parts and ten modules (a lecture, a simulation drill, skills training and a test). The first MCLS-CBRNE course was held in Shizuoka Prefecture on May 22, 2016. There were 24 participants and received written and practical examinations at the end of the course. The occupation, MCLS provider or instructor, previous experience with training and age did not affect the score of the written and practical examination, and all of the participants passed the examination. The questionnaire survey showed that participants were highly satisfied with the MCLS-CBRNE program. The educational methods of the MCLS-CBRNE program were thought to be effective for all participants.

Keywords: MCLS-CBRNE, mass casualties.

INTRODUCTION

The management of mass casualties induced by chemical, biological, radiological, nuclear and explosive incident (CBRNE) and terrorist events requires special preparation to ensure safety and communication, in addition to the principle managements that are implemented in general mass casualty events such as a man-made disasters such as traffic accidents, airplane crashes, high-rise building fires or plant explosion, or natural disasters such as earthquakes, hurricanes or tornadoes. In Japan, CBRNE rapid response teams are deployed with fire departments, police or the military. However, the first responders to a disaster may be dispatched to a scene before it is identified as a CBRNE. For example, in the sarin gas attack on the Tokyo subway, the first responders from the fire department were dispatched to an explosive event and some of the first responders came into contact with sarin [1,2]. In the Tokaimura nuclear accident, emergency medical technicians were dispatched to treat patients with convulsions based on miscommunication. As a result, all of the technicians were exposed to radiation [3-5]. Following the September 11 attack on the World Trade Center, the first responders were dispatched to manage a collision between an airplane and a building. As a result, large numbers of rescue workers were injured or killed by the collapse of the buildings [6]. Accordingly, to solve the above-noted problems, the Japanese Association for Disaster Medicine developed a mass casualty life support course for chemical, biological, radiological, nuclear, and explosive incidents or terrorist events (MCLS-CBRNE) in 2015 for people who could be first responders to a CBRNE or terrorist events without the identification of the CBRNE [7]. This is the first educational program targeting CBRNE incidents to be established in Japan that targets first responders, including emergency medical technicians, firefighters, rescuers, police officers, coast guard staff, physicians, nurses and military personnel.

METHODS

The contents of the MCLS-CBRNE

The goals of the MCLS-CBRNE are as follows: 1) To develop a comprehensive all-hazard approach, in other words, to develop the comprehensive common principles for the initial activity at the scene of a CBRNE. 2) To comprehensively identify the measures that should be implemented in terrorist events, such as the importance of detection, zoning and decontamination from biological, chemical or radioactive contamination. 3) To teach the importance and characteristics of special personal protective equipment. 4) To develop the understanding of specific triage for decontamination. 5) To enable cooperation between related organizations such as fire departments, police, the army, administration, and other organizations at the scene of the CBRNE.

The MCLS-CBRNE contains four parts and ten modules (a lecture, a simulation drill, skills training and a test; Table 1, Figure 1 and 2). The MCLS-CBRNE is a one-day course that takes approximately 8 hours to complete in which 24 people can participate. The participation of police was essential. Participants with MCLS certification are also preferred. The MCLS-CBRNE was initially held in Tokyo on June 2015, and was subsequently held in 13 other prefectures. Emergency medical technicians, firefighters, police officers, military personnel, doctors, and nurses took part in the MCLS-CBRNE. Approximately 400 participants finished this course by June 2016.

Participants in the first MCLS-CBRNE course in Shizuoka Prefecture

The first MCLS-CBRNE course was held in Shizuoka Prefecture on May 22, 2016, at Takaga Fire Department. There were 24 participants, including a single female doctor. Two policemen and four officers on the Self Defense Force, including a retired member, participated as advisors. The 24 participants received written and practical examinations at the end of the course. The results of these examinations were analyzed with respect to age, occupation (doctor or fire fighter), the MCLS provider or instructor, and previous training experience regarding CBRNE. The statistical analyses were performed by χ^2-test, a non-paired Student's t-test, or Spearman's rank correlation coefficient. A p value < 0.05 was considered to indicate a statistically significant difference. We obtained permission from the participants orally during the course to perform these analyses. In addition, a questionnaire survey regarding the participants' satisfaction with each module was also distributed.

The protocol of this study was approved by our institutional review board, and the examinations were conducted according to the standards of good clinical practice and the Helsinki Declaration.

RESULTS

All 24 participants passed both the written and practical examinations. There was no relationship noted between the written and practical examination scores (R= 0.01, p = 0.8).

The results of the analysis concerning the written examination are shown in Table 2. The occupation, MCLS provider or instructor, and previous experience with training did not affect the score of the written examination. There was no relationship noted between the written examination scores and age (R= 0.00, p = 0.9).

The results of the analysis concerning the practical examination are shown in Table 3. The occupation, MCLS provider or instructor, and previous experience with training did not affect the score of the practical examination. There was negative weak relationship noted between the practical examination scores and age (R= -0.3, p = 0.1), but this was not significant.

The questionnaire survey showed that 22/24 (92%) participants were highly satisfied with the MCLS-CBRNE program.

Fig-1: A scene from the lecture at the first course in Shizuoka prefecture Participants learn the principles of disaster medicine and the management of a mass casualty event.

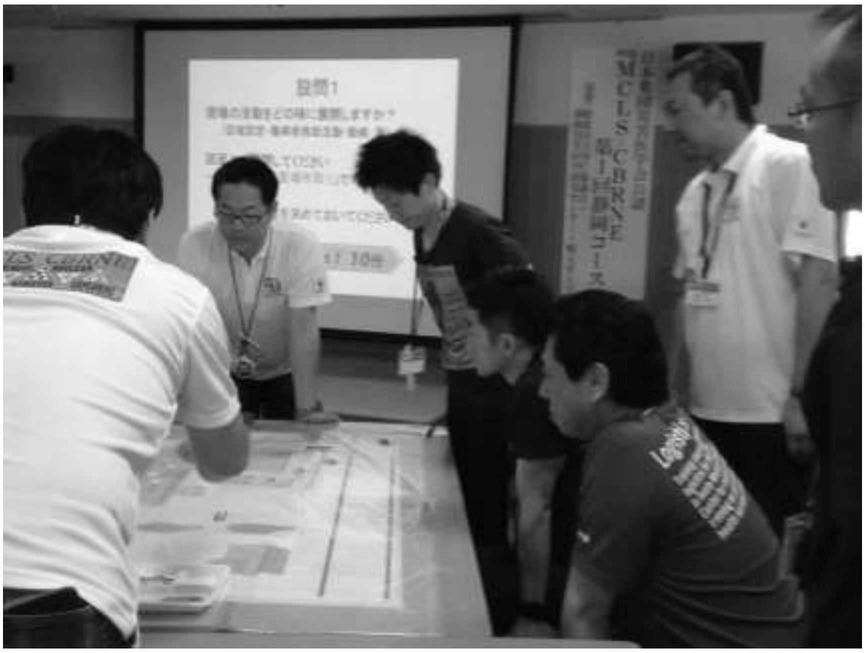

Fig-2: A scene from a simulation drill at the first course in Shizuoka prefecture. The participants, who are divided into 2-5 groups, discuss the management of the same mass casualty scenario in each group, and present the results of the discussion to the other groups.

Table-1: Curriculum for the mass casualty life support course (MCLS) for chemical, biological, radiological, nuclear or explosive incidents (CBRNE) established by the Japanese Association for Disaster Medicine

1. Lecture

1) Introduction to the CBRNE
- Timing of switching from common disaster to CBRNE
- First action on site for CBRNE as an extension of the normal activity for a general first responder (All hazard approach)

2) Review of the MCLS
- Report of mass casualty event
- Declaration of commander
- Securing safety for self, scene and survivor
- Securing communication tools
- Reporting details of the event and requesting a support unit and medical staff
- Zoning and settlement of command post

3) Common characteristic of CBRNE disasters
- Difficulty of recognizing a CBRNE event for a first responder
- Hazards for first responders
- Need for special equipment for detection, protection and decontamination
- Triage for pre- and post-decontamination

4) Specifics of each type of CBRNE disaster
- Toxidrome (nerve, blood, blister and choking agents), antidote, biological agents, public health surveillance
- Internal and external exposure to radiation, dirty bomb
- Blast injuries (primary, secondary, tertiary, quaternary)

5) Detection, zoning, personal protective equipment, decontamination
- Ion mobility spectrometer, radiation detector
- Hot, warm, cold zone
- Protection (levels A-D)
- Dry and wet decontamination, undressing and wiping off

2. Simulation drills to be carried out on a desk

6) Scenario No.1; Role of the party that is the first to arrive on the scene of a CBRNE disaster Experience with the difficulty of switching from standard to CBRNE mode after contamination

7) Scenario No.2; Setting up and arranging the zoning and staff before and after the arrival of special units for CBRNE

Clarification of the safety zone and changing zone after the arrival of special units for CBRNE
Time limits of rescue operation wearing clothing with level A protection
8) Scenario No.3; Setting up and arranging the zoning and staff before and after the arrival of special units for CBRNE
Experience with the difficulty of continuing rescue operations after suffering damage from a dirty bomb

3. Practical skill training
9) Detection and triage before and after decontamination

4. Test of skills and knowledge

Table 2. Analysis results for the written examination

	Mean ± SD	Mean ± SD	p-value
Doctor (n=7) vs. Fire fighter (n=17)	94.2 ± 2.1	89.6 ± 8.6	n.s
Instructor (n=20) vs. Provider (n=4)	91.8 ± 8.5	87.0 ± 6.8	n.s
Previous experience with CBRNE training: no (n=9) vs. yes (n=15)	94.6 ± 6.3	88.8 ± 8.8	n.s

vs: versus, SD: standard deviation, n.s.: not significant

Table 3. Analysis results for the practical examination

	Mean ± SD	Mean ± SD	p-value
Doctor (n=7) vs. Fire fighter (n=17)	28.5 ± 0.9	28.4 ± 1.4	n.s
Instructor (n=20) vs. Provider (n=4)	28.6 ± 1.0	28.0 ± 2.3	n.s
Previous experience with CBRNE training: no (n=9) vs. yes (n=15)	28.4 ± 1.3	28.5 ± 1.3	n.s

vs: versus, SD: standard deviation, n.s.: not significant

DISCUSSION

We herein reported the contents of the MCLS-CBRNE program and described its effects on participants after completing the course. The age, occupation, MCLS provider or instructor, and previous experience with training did not affect the score of either the written or practical examination, or all of the participants passed the examination. As such, the educational methods of the MCLS-CBRNE program were thought to be effective for all participants.

Subbarao *et al*. reported on a simulation-based CBRNE course to educate participants on the recognition, triage, and resuscitation of contaminated victims using high-fidelity mannequin-based simulations and video clinical vignettes [8]. They found statistically significant differences in the pre- and post-training scores at all levels of learning. Unfortunately, we did not assess the pre-training score in the MCLS-CBRNE course, so a direct evaluation of the effect of the course could not be performed. However, the most important point of the training was to determine how suitably the performance of the initial action could be executed to prevent self-injury to first responders and disaster-related death and disability when a student unexpectedly encountered an MCLS-CBRNE event. The degradation of skill and knowledge is common after taking part in a course, even when high-fidelity patient simulators are used [9]. In addition, evaluating participants a short time after training has been shown to yield favorable results with regard to the preservation of skill and knowledge, and the reported satisfaction among students is usually high, similar to the present findings [10-12]. While, Stevens et al. reported the results of an online survey among paramedics in Australia concerning perceived CBRNE response readiness [13]. In the final multivariate model in their study, recent training was higher readiness, irrespective of incident experience. Accordingly, to prevent the degradation of skill and knowledge related to CBRNE, remedial training should be provided as often as required [14].

A standardized 'blueprint' of role-specific competency criteria for CBRNE incidents is needed for all emergency healthcare staff or medical students. The results of the questionnaire survey in the present study suggest that our MCLS-CBRNE course may be useful in this respect [15-17].

CONCLUSION

The educational methods of the MCLS-CBRNE program were thought to be effective for all participants.

Conflict of interest statement

The authors declare no conflicts of interest in association with this study.

Acknowledgement

Corresponding author, Youichi Yanagawa, received fund from Ministry of Education, Culture, Sports, Science and Technology-Supported Program for the Strategic Research Foundation at Private Universities, 2015-2019; The constitution of total researching system for comprehensive disaster, medical management, corresponding to wide-scale disaster.

REFERENCES

1. Okumura T, Takasu N, Ishimatsu S, Miyanoki S, Mitsuhashi A, Kumada K, Hinohara S, et al.; Report on 640 victims of the Tokyo subway sarin attack. Ann Emerg Med, 1996; 28(2):129-35.
2. Maekawa K; Medical aspect for chemical disaster. Information in acute phase of the Tokyo subway sarin attack. J Clin Exp Med, 1996; 177(11)731-735.
3. Kanamori M, Suto T, Tanaka K, Takada J; A study on dose control for Tokaimura criticality accident termination. Radiat Prot Dosimetry, 2011; 146(1-3):42-5.
4. Kobayashi Y; Learning points from JCO criticality accident at Tokai-mura in 1999. Prehospital Care, 2011; 24(3):18-21. In Japanese
5. Tanaka SI; Summary of the JCO criticality accident in Tokai-mura and a dose assessment. J Radiat Res, 2001; 42 Suppl: S1-9.
6. Centers for Disease Control and Prevention (CDC); New York City Department of Health response to terrorist attack, September 11, 2001. MMWR Morb Mortal Wkly Rep. 2001; 50(38):821-2.
7. MCLS-CBRNE Working group; Development of Mass Casualty Life Support-CBRNE (MCLS-CBRNE) in Japan. Prehosp Disaster Med in press, 2016.
8. Subbarao I, Bond WF, Johnson C, Hsu EB, Wasser TE; Using innovative simulation modalities for civilian-based, chemical, biological, radiological, nuclear, and explosive training in the acute management of terrorist victims: A pilot study. Prehosp Disaster Med, 2006; 21(4):272-5.
9. Settles J, Jeffries PR, Smith TM, Meyers JS; Advanced cardiac life support instruction: do we know tomorrow what we know today? J Contin Educ Nurs, 2011; 42(6):271-9.
10. Hirose T, Iwami T, Ogura H, Matsumoto H, Sakai T, Yamamoto K, et al.; Effectiveness of a simplified cardiopulmonary resuscitation training program for the non-medical staff of a university hospital. Scand J Trauma Resusc Emerg Med, 2014; 22:31.
11. Nishiyama C, Iwami T, Kitamura T, Ando M, Sakamoto T, Marukawa S, et al.; Long-term retention of cardiopulmonary resuscitation skills after shortened chest compression-only training and conventional training: a randomized controlled trial. Acad Emerg Med. 2014;21 (1):47-54.
12. Heinrichs WL, Youngblood P, Harter P, Kusumoto L, Dev P; Training healthcare personnel for mass-casualty incidents in a virtual emergency department: VED II. Prehosp Disaster Med, 2010; 25(5): 424-32.
13. Stevens G, Jones A, Smith G, Nelson J, Agho K, Taylor M, Raphael B; Determinants of paramedic response readiness for CBRNE threats. Biosecur Bioterror, 2010; 8(2):193-202.
14. Hamilton R: Nurses' knowledge and skill retention following cardiopulmonary resuscitation training: a review of the literature. J Adv Nurs, 2005; 51(3):288-97.
15. Mitchell CJ, Kernohan WG, Higginson R; Are emergency care nurses prepared for chemical, biological, radiological, nuclear or explosive incidents? Int Emerg Nurs, 2012; 20(3):151-61.
16. Feeney JM, Ziegler K, Armstrong JM, Shapiro D; Terrorist Event Training in US Medical Schools. A Survey of Chemical, Biologic, Radiologic, Nuclear, and High-Yield Explosives Training in US Medical Schools. Conn Med, 2015; 79(10):581-5.
17. SteelFisher GK, Blendon RJ, Brulé AS, Lubell KM, Jackson Brown L, Batts D, Ben-Porath E; Physician Emergency Preparedness: A National Poll of Physicians. Disaster Med Public Health Prep, 2015; 9(6): 666-80.