

## Special Disaster and Civil Protection Law — Special disaster lurking in everyday clinical practice —

JMAJ 56(1): 45–50, 2013

Yukiya HAKOZAKI\*<sup>1</sup>

**Key words** CBRNE terrorism, Injectional anthrax, Food poisoning, Polonium-210, Civil Protection Law

The phrase “special disaster” typically evokes images of chemical, biological, radiological, nuclear, and explosive (CBRNE) terrorism; however, chemical-induced illnesses have been reported in everyday clinical practice in Japan. Pertinent examples include cases of organophosphorus poisoning from frozen *gyoza* (fried meat dumplings) imported from China in 2007 and 2008, several cases of suicide attempted using hydrogen sulfide in 2008, and the outbreak of gas poisoning triggered by a man who took chlorpicrin to commit suicide. Access to biological agents (e.g., anthrax) or precursors of chemical agents (e.g., nerve or blister agents) is strictly regulated by the rules of the Chemical Weapons Convention and Biological Weapons Convention, and also monitored by the Australia Group, and the military production of biological/chemical agents by terrorist groups is believed to be extremely difficult. Under these circumstances, biological/chemical weapons management and research centers in the USA warn that intentional chemical disasters such as the destruction of chemical factories, distribution of industrial chemicals, or mixing chemical agents into foods is highly probable. Warnings of the same nature have also been voiced about biological agents.

### Cases Seen in Clinical Practice Involving Chemical/Biological Agents and Radioactive Materials

#### Anthrax cases in metropolitan areas

In July 2006 in Scotland, a 50-year-old man,

a craftsman who made drums using the skins of unprocessed animals (sheep and badgers) imported from Africa, inhaled anthrax spores and died. He developed a fever on July 5th and was admitted to hospital on July 7. He was diagnosed with meningitis and septicemia and received antibacterial drugs, but died 3 hours after he was admitted to the intensive care unit. Pathological autopsy confirmed the presence of anthrax in the lungs, brain, and kidneys. In December 2009, in the state of New Hampshire in the USA, intestinal anthrax infection was found in a member of a drum group, and anthrax spores were found on the skins of 2 of his drums that had been made in Africa. There have been reports of 1 case of pulmonary anthrax in the USA (2006), 2 cases of cutaneous anthrax in the USA (2007), 1 case of pulmonary anthrax in England (2008, dead), and 1 case of intestinal anthrax in the USA (2009). Medical professionals of any region in the world, including advanced countries, should be aware of the possibility of diagnosing anthrax cases.

In 2009, there were 47 definitive cases of anthrax infection among English heroin users (70% men, 30% women) with the average age of 35 years (range: 22–55 years). Of those 47, 13 died, increasing the mortality rate to 28%. Infected heroin users were found not only in England but also in Germany, and “severe, soft tissue infections, with significant soft-tissue oedema” at the site of heroin injection was the characteristic finding.<sup>1</sup> Anti-anthrax immunoglobulin was used to treat 15 of these anthrax

\*1 Department Head of the 1st Internal Medicine, Self-defense Force Central Hospital, Tokyo, Japan (yukiya-ha.ko@nifty.com). This article is based on the lecture presented at the 2012 JMAT Training Course on Disaster Medicine held on March 10, 2012.

patients. Unlike the 3 previously known modes of infection (i.e., inhalational, gastrointestinal, and cutaneous), these were cases of injectional anthrax. Marijuana and opium are inhaled, but heroin is injected intravenously. This difference likely accelerated the spread of infection. As for the exact source of infection, some claim that the heroin had been transported in goat skins (mainly from Afghanistan) infected with anthrax spores (the “contaminated heroin” theory), while others believe that the white bone powders used to cut the heroin were infected (the “animal bone powder” theory), but the truth remains unknown.

The initial symptoms of anthrax infection are nonspecific, such as fever or malaise; thus, early diagnosis is difficult. People engaged in certain occupations (e.g., those of the grazing livestock industry), habitual users of heroin, and people who are exposed to anthrax through terrorist activity are more vulnerable to infection. When anthrax infection is suspected, Gram staining or culture of blood and surgically removed tissue samples are generally conducted, but polymerase chain reaction assay or immunohistochemical staining is effective for definitive diagnosis.

#### Cases that resemble food poisoning

On July 25, 1998, at around 6:00 pm, 67 people developed acute arsenic poisoning after eating curry tainted with arsenic at a summer festival in the Wakayama Prefecture, Japan. Of these, 63 were hospitalized and 4 died.<sup>2</sup> Nausea and frequent vomiting were commonly observed, beginning approximately 10 minutes after ingestion of the poisoned food. Clinical gastrointestinal symptoms were nausea (92%), vomiting (93%), and diarrhea (54%); and clinical neurological symptoms were lassitude (32%), headache (43%), motor paralysis (5%), and dysesthesia (5%). At first, a local public health center announced the incident as food poisoning (e.g., *Staphylococcal enterotoxin*, *Bacillus cereus*) around midnight of the same day, and 3 cases of cardiac arrest occurred before the next morning. At 6:00 am the next day, the police reported that cyanide (stable form) had been found in the patients' vomitus. On August 2 (9 days after the incident), the police made a final report stating that an arsenic compound had been detected in the leftover curry. Because severe vomiting

occurred immediately after eating the curry, medical experts had questioned the possibility of food poisoning or cyanide poisoning from the beginning. Clinical symptoms and findings in cases of arsenic poisoning are variable and often resemble those of other diseases. Therefore, definitive diagnosis is extremely difficult unless there is an announcement of the poisoning before or immediately after an incident by the offender.

In late January 2008, 10 people from 3 families in different parts of Japan (7 of 2 families in the Chiba Prefecture and 3 of 1 family in the Hyogo Prefecture) suffered from food poisoning after eating imported frozen *gyoza* (manufactured by Tianyang Food, China); methamidophos was later found in the food.<sup>3</sup> On January 22, 5 members of one of these families that lived in Ichikawa City (Chiba) complained of vomiting and other symptoms after finishing a family dinner; all of them were hospitalized. A 5-year-old girl temporarily lost consciousness and her condition became critical. Others in the family also became seriously ill, but all fully recovered and returned home. This family had eaten commercially available frozen *gyoza* for dinner at approximately 8:00 pm. The 5-year-old girl complained of severe stomachache, vomiting, and diarrhea around 8:30 pm and was transported to the pediatric care unit of a hospital. The girl's symptoms were intense, including bowel and urinary incontinence, and she was intubated and placed on artificial respiration for respiratory failure. A public health center received a report of mass food poisoning the next morning, but a physician observed pupillary miosis in the 5-year-old girl and examined the blood cholinesterase levels of all family members under the suspicion of organophosphorus poisoning. In all cases, the levels were 5–50% below the lower standard limit, and they were diagnosed with organophosphorus poisoning.

Medical institutions in urbanized areas rarely treat cases of organophosphorus poisoning, and obtaining a correct diagnosis can take time. In the case of food poisoning that becomes symptomatic immediately after the meal, a physician needs to check for pupillary miosis and blood cholinesterase levels, along with taking a detailed medical history. There are various chemicals contained in food items that can adversely affect health, such as food additives, residual agricul-

**Table 1 Factors to consider when determining the cause of food poisoning**

Factors to consider as the cause of poisoning	Precedents
Food items (or non-food items)	Case in Panama (medicine) Multiple cases of acute encephalopathy in the Tohoku and Hokuriku regions of Japan ( <i>Pleurocybella porrigens</i> , 2004)
Chemicals or microbes (or natural toxin of plant or animal origin)	Cases in Angola (bromides) Case in Panama (cold medicine contaminated with diethylene glycol)
Known substances (or unknown substances/factors environment causes such as weather, etc.)	Cases of mountain vegetables (e.g., <i>Matteuccia struthiopteris</i> , wild <i>Tricholoma equestre</i> , <i>Pleurocybella porrigens</i> )
Intentional acts	Cases of ground beef mixed with nicotine Case of poisoned curry in Wakayama, Japan Cases of Chinese rat poison poisoning Case of frozen <i>gyoza</i> (made in China) mixed with methamidophos
Social or psychogenic factors	Feeling sick after consuming Coca-Cola products in Belgium

tural chemicals, residual drugs given to farm animals, and pollutants (e.g., dioxin, PCB materials, heavy metals, mycotoxins, acrylamide, and other secondary products). Toxic chemicals can also be found in health supplements, herbal products, diet foods (e.g., Chinese-manufactured *N*-nitroso-fenfluramine-containing diet food items that cause liver dysfunction), and other consumed substances (e.g., genetically modified food, irradiated food, and allergen-containing food) (Table 1). We need to establish systems for prompt information sharing, diagnosis, and treatment in order to prepare for cases of illness for which contaminated food is the suspected cause.

#### **A case of an emergency medical center contamination during treatment of a patient who had taken a chemical agent**

On May 21, 2008, the emergency care unit of the Japanese Red Cross Kumamoto Hospital (Kumamoto, Japan) received a transport request for a male patient (age 34 years) who had attempted suicide by taking an agricultural chemical, chloropicrin.<sup>4</sup> The patient was brought into the initial treatment room of the emergency medical center, and the medical staff began emergency procedures (oxygenation, securing an intravenous line, and suctioning of the stomach contents) while wearing goggles, masks, protective suits, and gloves. Immediately after the gastric tube had been placed and stomach

contents suctioned, the patient vomited. The vomit produced an intensely irritating smell, and the staff (31 people) as well as other patients and their visitors (23 people) complained of lacrimation, coughing, and breathing difficulty, and panic set in. Some members of staff attempted to physically reach the patient, but the intensely irritating smell made him difficult to approach. The patient was confirmed dead at 11:30 pm. Chloropicrin, an asphyxiating gas, was used as a chemical weapon during the First World War along with phosgene. Its toxicity is low, and it has subsequently been used mainly as tear gas. Because chloropicrin does not leave residue on crops, it is widely used in Japan as a soil pesticide and fumigant. In a mass disaster caused by an agent that has been used as a chemical weapon, medical staff involved in clinical practice may have no choice but to serve as first responders. Hospitals of any capacity are advised to be ready to provide a minimum level of response to a medical emergency caused by chemical exposure.

#### **Cases of acute radiation damage due to internal exposure**

In November 2006, Alexander Litvinenko (age, 44), a former officer of the Russian Federal Security Service, died suspiciously, and polonium-210 (Po-210) was found in the victim's urine.<sup>5</sup> He had become ill after having dinner at a sushi

restaurant in London on November 1 and was admitted to hospital. The Metropolitan Police Service started an investigation under the suspicion of murder by poisoning. They initially suspected the use of thallium, a heavy metal with high toxicity. The victim was treated at the intensive care unit, but he died on November 23 due to multiple-organ failure. A large amount of Po-210 was found in the victim's body on November 24. When Po-210 is absorbed,  $\alpha$ -rays cause cellular damage in tissues and rapidly induce acute radiation syndrome, and the outcome is death from multiple-organ failure. Po-210 is highly radioactive, and its lethal dose is approximately  $10\ \mu\text{g}$  in its chloridated form (reference: the lethal dose of potassium cyanide is 0.15 g). However, the marketing and transport of Po-210 is strictly regulated, and the purchase price is extremely high, making it very difficult to obtain a lethal dose unless state power is involved. Unlike other radioactive materials, Po-210 is unique in that it only emits  $\alpha$ -rays, making it easy to shield and transport. This unique property makes Po-210 a less likely weapon for radiation terrorism, where the intention is to expose as many people as possible at the same time. Nonetheless, as we saw with the accident at the Fukushima Daiichi Nuclear Power Plant, widespread contamination of radioactive materials can produce immeasurable fear in general society.

### Civil Protection Law and Response Training

The *Act Concerning the Measures for Protection of the People in Armed Attack Situations, etc.* in Japan, commonly called the Civil Protection Law, stipulates the measures to be taken by the central government and local public bodies in response to an armed attack. The required responses include the evacuation and rescue of Japanese citizens in order to protect their lives, bodies, and property, and to minimize the effect on the public in the event of an armed attack from a foreign country or terrorist organization. Armed attacks are organized into 4 categories: guerrilla or special-force assault, invasion by landing (enemy vessels come ashore and invade), ballistic missile attack, and air strike. The basic guidelines require the designated administrative agencies, local public bodies, designated public

agencies, and designated local public agencies to develop specific plans for the evacuation and rescue of residents and for response to armed attacks and disasters (called "civil protection plans" or "civil protection task plans"). For instance, prefectural governors are responsible for announcing warnings and giving orders to evacuate through the administrative radio system for disasters and emergencies. The Civil Protection Law also clearly states that organizations with a public presence, such as the Japanese Red Cross or NHK (the Japan Broadcasting Corporation), have a role in broadcasting warnings, transporting evacuees, and providing emergency aid. Developing civil protection plans is compulsory, and so is the training needed to implement those plans. Prefectural governments have been carrying out such training independently or jointly with the central government, but many municipalities have not fully developed their plans or conducted training.

In the Fiscal Year 2010, 10 prefectures successfully carried out 9 civil protection training programs (mapping training in 7 prefectures and practical training in 3 prefectures). A civil protection joint practical training led by the central government was conducted on January 30th, 2011 in Mito City (Ibaraki); the hypothetical situation was blast damage caused by an explosive containing radioactive material. This particular training drill was the first in Japan to assume radiation terrorism through the use of a so-called "dirty bomb." The training involved providing care at medical institutions not designated as radiation emergency facilities with the support of radiology-specialized institutions from within and outside the prefecture and through collaboration with the designated facilities.

This first training drill against radiation terrorism went smoothly and achieved much success. However, during the Fukushima Daiichi Nuclear Power Plant accident that followed the Great East Japan Earthquake on March 11, 2011, major problems were observed. For example, the evacuation of patients from some local hospitals was considerably delayed. In CBRNE terrorism, and especially in nuclear and radiation disaster, evacuation from contaminated areas presents great difficulty for those who are particularly vulnerable to disaster, such as housebound patients and residents of long-term care

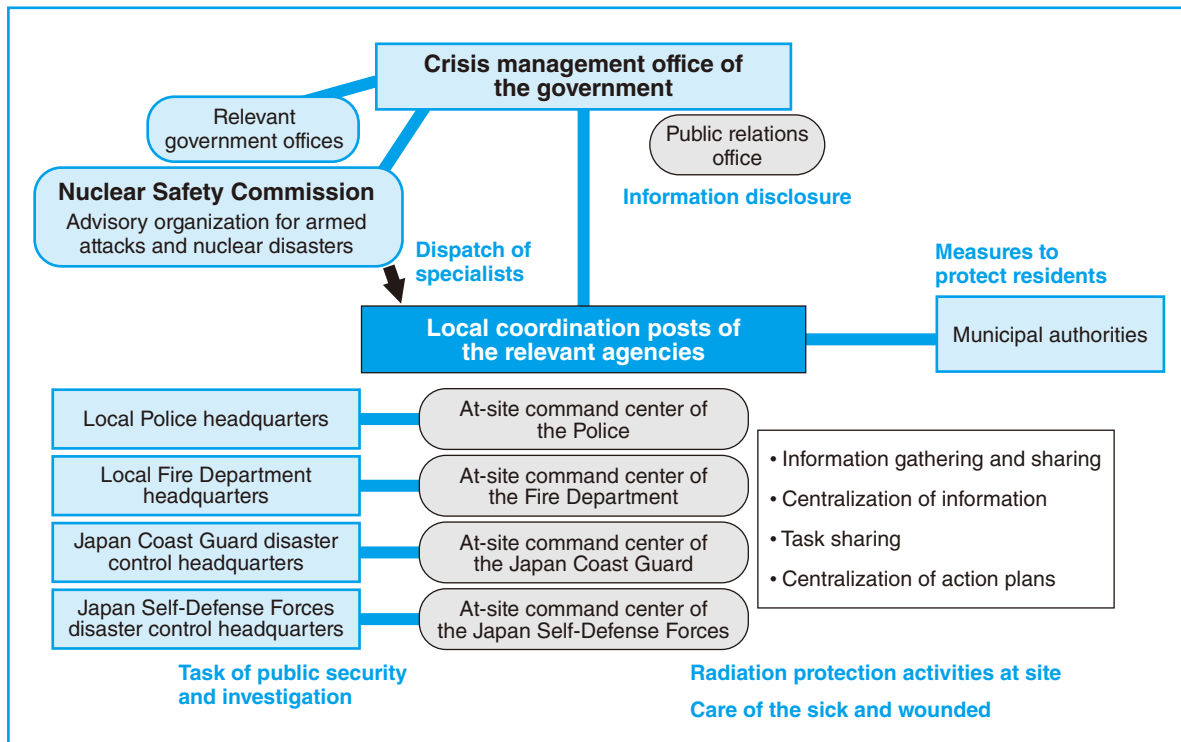


Fig. 1 Overview of the organizations required to respond to nuclear and radiation terrorism

facilities. The Civil Protection Law adapts a scheme for nuclear disaster to respond to nuclear and radiation terrorism (Fig. 1). This scheme states that information, task sharing, and action plans are to be centralized at “local coordination posts of the relevant agencies,” and those agencies are also held responsible for collecting and sharing information. However, the lesson of the Fukushima nuclear plant accident tells us that the responsibilities and powers of the “local coordination posts of the relevant agencies” must be re-examined to give more authority to the command centers.

### Future Issues

For medical professionals involved in everyday clinical practice, it is not easy to imagine a vicious act such as destroying a vehicle transporting chemicals or mixing a toxic substance into food or drinking water, or to anticipate an unexpected substance as the cause of a disease. When a large number of patients develop similar symptoms after being in an enclosed space (e.g., a theater

or shopping mall), physicians must take detailed medical histories and provide clinical diagnoses from the viewpoints of both biological and chemical agents (sometimes including radioactive materials) while considering the possibility of an intentional chemical disaster (Fig. 2). As the reviewed cases of arsenic-tainted curry and frozen *gyoza* have shown us, reaching a prompt diagnosis of chemical poisoning through food is extremely difficult unless there has been advanced notice. Initial responses (analyses, epidemiological test, etc.) as well as collaboration and information sharing between relevant institutions and agencies will significantly contribute to the reduction of adverse health outcomes for victims. Medical professionals are strongly advised to consider the possibility of intentional contamination with a chemical substance or toxin when the duration between food intake and the onset of symptoms is brief, or when non-gastrointestinal symptoms are present (including neurological symptoms such as lassitude and headache).

Medical professionals can encounter special

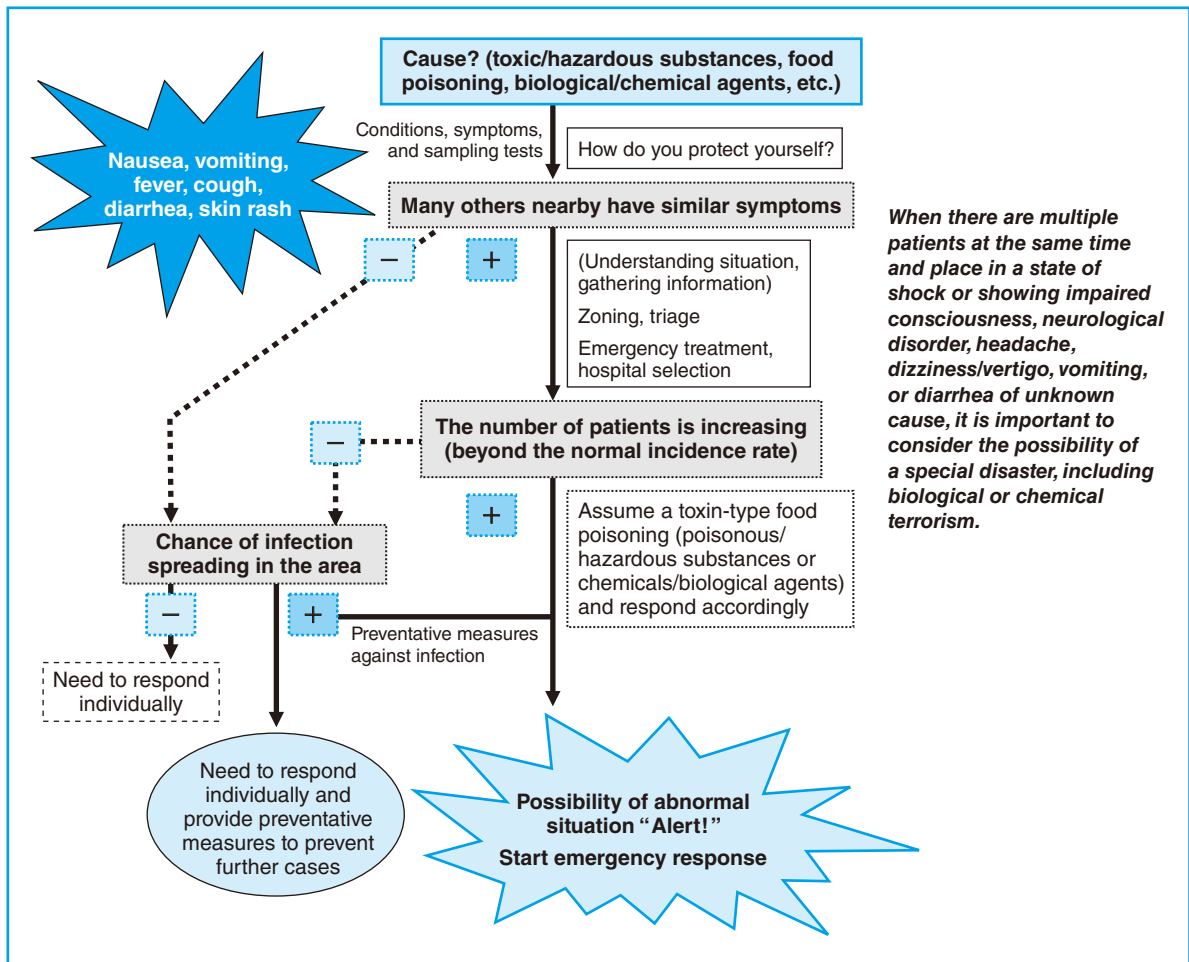


Fig. 2 The flow-chart of response actions to a patient outbreak of unknown cause

disasters even in their daily clinical practice and may even have to serve as first responders in a large-scale special disaster. Therefore, it is

essential for medical professionals to master the basic knowledge and skills to respond to special disasters.

References

1. Booth MG, Hood J, Brooks TJG, et al. Anthrax infection in drug users. *Lancet*. 2010;375:1345–1346.
2. Uede K, Shiotani A. Acute skin rash observed for victims of the poisoned curry case mixed with arsenic. *Skin Research*. 1999;41:511–517. (in Japanese)
3. Oode Y, Yoshihara T, Sumi Y. Methamidophos poisoning: a five years old girl's case. *The Japanese Journal of Clinical Toxicology*. 2009;22:48–50. (in Japanese)
4. Koyama H, Takamura M, Okumoto K. Risk management of the mass disaster induced by chloropicrin. *The Japanese Journal of Clinical Toxicology*. 2009;22:25–31. (in Japanese)
5. Fraser G, Giraudon I, Cohuet S, et al. Epidemiology of internal contamination with polonium-210 in the London incident, 2006. *J Epidemiol Community Health*. 2012;66:114–120.