

Diabetes care: After the Great East Japan Earthquake

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PREFACE

The Great East Japan Earthquake and subsequent tsunami destroyed large parts of Japan's Tohoku district. Special efforts were made regarding the prompt distribution of medical supplies, including insulin, for diabetic patients. However, many diabetic patients in the shelters lost their blood glucose control as a result of the unfavorable living environment. The high-calorie food provided led to severe postprandial hyperglycemia. Furthermore, mental stress can aggravate diabetic control and these patients require special mental care. We have a few suggestions to propose in preparation for future disasters based on the experience gained from our shelter visits during this disaster. First, people in the affected areas had no way of accessing such information in the early days after the disaster. Therefore, we should consider the practical means of distributing important information in various situations. Second, guidelines and manuals for both diabetic patients and healthcare providers need to be created for the various situations that occur in the event of a natural disaster. We already have a few, but situations vary and several guidelines are required to cover different conditions. Manuals for the prescription of antidiabetic agents will be useful, especially for doctors who are not specialized in diabetes. Third, patients should be educated beforehand as to what to do and what to be prepared for in the case of a disaster; each of the various situations that might be encountered should be covered. Lectures about these issues might be included in educational classes for diabetic patients organized by each medical institution. (*J Diabetes Invest*, doi: 10.1111/jdi.12025, 2013)

KEY WORDS: Diabetes care, Disasters, Great East Japan Earthquake

INTRODUCTION

A massive earthquake of magnitude 9.0 struck the Sanriku Coast of Japan on 11 March 2011 at 14:46 hours Japan Standard Time; the earthquake and the accompanying tsunami caused tremendous human and structural damage¹. The earthquake has been named the Great East Japan Earthquake, and along with the tsunami, it devastated the Tohoku district and other surrounding regions. More than 15,000 people died, and 1 year later, approximately 3,000 people are still missing according to the National Police Agency². Unlike the Great Hanshin-Awaji (Kobe) earthquake in 1995 (magnitude 7.2 on the Richter scale)³, which resulted in a huge loss of life mainly because of people being crushed to death, burnt or receiving penetrating injuries⁴, most of the victims of the Great East Japan Earthquake were drawn into or swept away by the tsunami. The disaster rendered tens of thousands of people homeless, and the survivors had to evacuate to shelters. The earthquake and tsunami also caused extensive and severe structural damage to roads and railways, complicating the distribution of necessary materials, such as food and medical supplies. The serious problem of the Fukushima nuclear plant made the

situation worse, and significantly impacted individuals in the surrounding area.

PROVISION OF NECESSARY INFORMATION

In the affected area, many patients with diabetes lost their oral antidiabetic agents or insulin; some of these medications were lost when the patients' houses collapsed, whereas other patients' medications were washed away by the tsunami. As insulin injections are indispensable for the survival of patients with type 1 diabetes and some patients with type 2 or other types of diabetes, the dissemination of information on how such patients could obtain insulin injections was critical⁵. On 13 March, 2 days after the earthquake, the Japanese Diabetes Society (JDS) set up an emergency disaster-response headquarters. The headquarters investigated the extent of the damage, the states of the medical facilities in the area and the status of insulin distribution in each prefecture of the Tohoku district. A special site to provide advice to individuals requiring insulin treatment was also opened. The Japan Association for Diabetes Education and Care (JADEC) and the Diabetes Information Center of the National Center for Global Health and Medicine (NCGM) also opened a special site to provide useful information to diabetic patients. In areas where the Tokyo Electric Power Company supplied electricity, rolling blackouts were initiated on 14 March to compensate for the power shortages caused by the earthquake. Three companies that manufactured insulin jointly and officially announced methods for maintaining

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insulin in a refrigerator during the blackout period. In these manners, the organizations concerned made an effort to provide the necessary information as soon as possible.

IMPORTANCE OF DAILY PREPARATION

Although obtaining rapid and accurate information is important, especially in an emergency situation, people in the affected area often faced difficulties obtaining the information they required because of the electrical blackouts. In a country such as Japan, where earthquakes are frequent, the time and place of the next earthquake cannot be predicted. Under these circumstances, the daily stock of necessary supplies and mental preparation in case of an emergency are crucial. As a precaution against natural disasters, including earthquakes, people should prepare an emergency bag that they can carry by themselves; this bag should be kept in a place that can be easily accessed during an emergency. In this emergency bag, patients with diabetes should pack antidiabetic agents, an insulin injection kit, a blood glucose self-monitoring (SMBG) kit, glucose in case of a hypoglycemic attack, a notebook or a card in which their medications are recorded and, if instructed by a healthcare provider, a glucagon injection kit. The discontinuation of insulin injections might lead to serious conditions, such as ketoacidosis, in patients with type 1 diabetes; therefore, such patients should keep extra insulin in multiple places. When a disaster occurs, patients might not be at home; some might be at their offices or at school. Therefore, patients with type 1 diabetes should keep extra insulin injection kits in such places.

PRACTICAL MANUAL FOR TYPE 1 DIABETES

A non-profit corporation, the Japan IDDM Network, has published a manuscript titled, 'Manual for Type 1 Diabetes, Part 3: In Case of Disaster', which instructs patients to remain calm and to gather their wits in case of an emergency. It states that if patients have sufficient supplies capable of lasting for approximately 1 week, they need not worry. Furthermore, the manual states that in the event of a disaster, an unstable blood glucose level is not uncommon. It also states that because patients might not be able to have regular meals, they should ensure that their blood glucose level is maintained at a relatively high level. Even if patients usually administer insulin injections before meals, the manual recommends that they can administer their insulin injections after meals to avoid hypoglycemia, depending on the amount of food that they eat. The manual also contains some practical advice. For example, it states that patients can use the same needle repeatedly in an emergency; that they should inject insulin even if they do not have a swab; and that if they cannot self-monitor their blood glucose level, they can guess their blood glucose level and continue to inject insulin after adjusting the units to be administered based on their own experience. Suggestions relating to mental health that might be useful not only for patients with diabetes, but for all individuals living in emergency shelters, are also provided. For example, the manual states that patients should not shoulder

their worries or anxieties alone, but should approach someone for advice.

MEDICATION FOR TYPE 2 DIABETES

For patients with type 2 diabetes who are being treated with oral hypoglycemic agents, the patients' ordinary treatment regimens should ideally be continued. However, if they lose their medication in a disaster or if they are no longer able to consume a fixed amount of food, they should be given individual suggestions depending on the type of medication prescribed. The homepage of the JADEC, for example, states that the discontinuation of the α -glucosidase inhibitors, biguanides and thiazolidinediones, is accompanied by a low risk of the rapid deterioration of diabetic control; however, patients treated with sulfonylurea or glinides should be wary of a hypoglycemic attack if they consume a smaller amount of food than usual, and the dosage of their medication should be adjusted accordingly. For example, the drug dosage can be reduced to half or one-third of the normal dosage, depending on the amount of food they are able to eat. Incretin-related drugs, such as dipeptidyl peptidase-4 (DPP-4) inhibitors, glucagon-like peptide (GLP)-1 analogues and GLP-1 receptor agonists, are associated with a low risk of hypoglycemia when they are used as a monotherapy, and patients can take their usual dose as long as they have a meal. For patients with type 2 diabetes who are treated with insulin injections, the pathophysiological conditions of the patients are so diverse that individual care is required.

OUR EXPERIENCES IN THE AFFECTED AREA

Six hours after the earthquake, the NCGM sent the Disaster Medical Assistance Team (DMAT), a group of professional medical personnel trained to provide rapid-response medical care to Sendai in Miyagi prefecture, located in the Tohoku district. After the DMAT had completed its activities, approximately 250 members of the NCGM's medical support teams composed of doctors, nurses, pharmacists, clinical psychologists and clerical staff were sent to over 50 shelters in Higashimatsushima City, which is located 20 km north of Sendai, to provide care to patients with chronic diseases including diabetes, hypertension, respiratory diseases and mental illnesses⁶. In cooperation with local public health nurses, the teams also carried out a health survey of people who resided at home. By the end of April 2011, we had examined and treated more than 1,110 patients for 1.5 months after the earthquake. A total of 40% of these patients were men and 60% were women; approximately 65% were elderly (age ≥ 60 years). In the early stages after the disaster, the major conditions observed were upper respiratory inflammation and hypertension. Many patients also suffered from hay fever and bronchial asthma triggered by the dust. Some patients were soaked for many hours in the seawater brought by the tsunami, causing eczema or dermatitis. As stated in previous reports⁷⁻¹⁴, the diabetic conditions of many diabetic patients deteriorated because of the unfavorable living environments.

One of the authors of the present report was a member of the medical support team of the NCGM and visited the affected area approximately 50 days after the disaster. Even within the same district, a large gap existed between the areas that had already recovered and the areas that remained far behind in their recovery. An enormous amount of debris had piled up, especially along the coast. Many patients had lost their medication records or, even if they had them, the records were not discernible because the text had been damaged by the seawater brought in by the tsunami. To help patients remember the medications they were on before the earthquake, we showed them catalogs with colored photographs of oral antidiabetic drugs and insulin manufactured by the three major insulin companies. Even when we could identify the medications that they had been receiving, we sometimes had to change their medications to maintain their blood glucose levels at a relatively high level so as to avoid hypoglycemia. Instead of maintaining a strictly controlled optimal blood glucose level, this approach was used, because some of the patients had lost their appetite as a result of the deep sorrow that they were experiencing over the loss of family members and property.

Ideally, we expect diabetic patients to adjust their medication by themselves according to their general condition, just as they used to do on a 'sick-day'. However, this is not an easy task, especially for the elderly. Therefore, education not only for patients, but also for local doctors who do not specialize in diabetes, is important to help these patients adjust their medications. When visiting doctors specializing in diabetes and local doctors in affected areas were well coordinated, we were able to ask the local doctors to follow the patients' glucose levels carefully in order to achieve stricter glycemic control.

DIETS IN SHELTERS

The importance of an appropriate diet for diabetic patients during a natural disaster has been reported previously^{8,11,14}, but the need to live in refuge shelters made it very difficult for patients with diabetes to maintain a proper diet. Some shelters could not even provide basic meals, resulting in some diabetic patients experiencing hypoglycemia. In contrast, some shelters distributed meals that were high in carbohydrates and calories, such as sweet buns, rice balls, snacks and packaged milk or juice. Some diabetic patients experienced severe postprandial hyperglycemia, but they did not have a choice in relation to their diet because of the limited availability of food. Once transport improved, various kinds of materials were sent to the shelters and people had more food choices; however, shortages of fresh foods, such as vegetables, persisted.

We also examined many hypertensive patients in the shelters. Some patients might have been hypertensive before the disaster, but their conditions often worsened because of the discontinuation of their medication, stress, anxiety and sleeplessness¹⁵. Basically, hypertensive patients were advised to reduce their salt intake, but it was difficult for people living in shelters to follow this recommendation¹⁶. The instant noodles and soup that were

supplied contained high levels of salt, and sometimes people were even asked to finish all their soup to reduce sewage because of drainage problems. Dietary management after a disaster is very difficult; therefore, individual patient education before any disaster is important to aid decision-making when a disaster does occur. Diabetes is a chronic disease, and even after patients have moved to temporary housing, they still require continuous support and suggestions, including dietary advice, to optimize diabetes control.

NEED FOR PROPER EXERCISE

In shelters, where many people live together in a small space, people tend to sit or lie down for long periods of time and this increases the risk of deep vein thrombosis (DVT). Patients in shelters might not be capable of carrying out the same exercises that they used to carry out before the disaster, but for good diabetes control, the prevention of DVT and stress relief, simple exercises and stretching regimens are recommended. People living in a gymnasium with a hard floor often complained of back pain, particularly lumbago, and gentle back stretches would be helpful for such individuals. For example, they might have been instructed to lie on a firm surface and do knee to chest, pelvic tilt, pelvic lift and hip rolling exercises or to stand up straight and do simple exercises, such as side bending and backward bending, which are generally practicable even for the elderly. On its homepage, the JADEC introduced physical exercises for people living in shelters to prevent lumbago. Dehydration also increases the risk of DVT and aggravates diabetes control. Although we suggested that people should drink sufficient amounts of liquid to avoid dehydration, elderly people tended to limit their liquid intake because the lavatory was often far away, cold and unsanitary.

PRECAUTIONS AND PREVENTION OF INFECTION

Patients with diabetes are also at a higher risk of developing infectious diseases, and once infected, they require a longer time to heal than others. In crowded shelters, patients must protect themselves from infection by gargling, wearing masks and by carefully washing their hands. Some shelters had no running water and bottled water or wet wipes were used instead. We also observed that some patients injured their fingers while disposing of junk around their houses; furthermore, some patients punctured a foot by stepping on a nail. Thus, individuals working outdoors to clear debris should be advised to use masks, thick gloves and shoes with thick soles.

MENTAL HEALTH CARE

Mental health care is one of the most important issues in disaster-stricken areas^{3,7,17-20}. In addition to emotional responses, such as grief, loss, fear and anger, some survivors experienced survivor's guilt over surviving the death of a loved one or guilt about being better off than others^{21,22}. Living in shelters in unfavorable conditions increases stress in terms of privacy, food availability, lavatory use, duty assignments, income, jobs and

health³. The NCGM dispatched specialists in psychiatric medicine to shelters from the very early stages of the disaster. Psychiatric care should be provided even after victims have moved to temporary housing. In diabetic patients, in particular, mental stress can aggravate diabetes control^{10,23–25}. After the Great Hanshin-Awaji earthquake, glycemic control was aggravated in diabetic patients, and an association between chronic life-threatening stress and a worsening of metabolic control in diabetic patients has been suggested⁷.

Vulnerable people in shelters, such as the elderly, children and handicapped individuals, require special attention and mental health care, because they are often too reticent or are unable to fully express their feelings. In addition to the need for mental health care while in the shelters, care even after moving to temporary housing is also important. While people are living in shelters, interactions with other people living in the shelter or with medical teams, such as ours, are possible, even if such interactions might be insufficient. However, once these individuals and others have moved to temporary housing, they have less contact with others and some could feel isolated and depressed. Perhaps partly because of this reason, reports of alcohol-dependency increased after the Great East Japan Earthquake, as was the case in the Great Hanshin-Awaji earthquake³. Therefore, continuous and careful individual mental health care is required for patients with any disease or irrespective of the existence of a disease.

CONTRIBUTIONS OF VARIOUS PROFESSIONAL DISCIPLINES

For diabetes management, a multidisciplinary medical team is required. Our medical support team in the Tohoku district kept in close contact with each other and shared information. Doctors examined, treated and prescribed medications for patients with the help of nurses, who gathered the required information from the patients. Nurses also made lists of patients in shelters who required special attention and care, and they sent this information to the succeeding medical team. Pharmacists brought drugs and provided information to doctors when required. Suggestions made by the pharmacists were helpful, because not all the doctors who visited the shelters were diabetic specialists. Pharmacists also explained the drugs to patients and provided them with new medication records, which were important and useful to both the patients and the other medical staff who followed up with patient care (Figure 1). Local public health nurses, most of whom had also been affected by the earthquake, donated significant time and effort to providing direct support to the local victims, carrying out a health survey and exchanging information about local victims with the medical teams. Their self-sacrificing contributions should be highly respected. Dietitians, physiotherapists and clinical laboratory technicians did not visit the shelters with us, but these professionals were indispensable for maintaining the physical health of the individuals in the shelters. Dietitians are able to provide useful advice regarding appropriate diets, which is fundamental for diabetes management. Even in situations where the selection



Figure 1 | Pharmacists explaining drugs and preparing a new medication records for patients living in shelters.

of food is limited and the available foods are high in carbohydrates, dietitians are able to teach a carbohydrate counting method to patients requiring insulin injections^{10,26,27}. After the shelters were closed and people were moved to temporary housing, they often received less attention and care, compared with what they received when they were living in the shelters³. The elderly population, in particular, might not have been able to prepare a well-balanced diet because of deterioration in their physical capability and depression arising from their isolated circumstances. Therefore, special long-term support by dietitians is required. Physiotherapists are able to suggest appropriate exercises for people in shelters; these exercises contribute to the prevention of DVT and decrease mental stress. Well-trained clinical laboratory technicians are indispensable in examining and diagnosing DVT. Thus, each professional discipline has something to contribute to the medical care of people living in shelters. These disciplines should cooperate with each other, and transcend their own views and fields to work as members of a medical team in emergency situations.

IN SUMMARY: SUGGESTIONS FOR FUTURE DISASTERS

We have a few suggestions to propose in preparation for future disasters, based on the experience gained from our visits to shelters during this disaster. First, gathering reliable information during a disaster is, of course, important, and relevant associations provided various information about diabetes through the media including details such as insulin distribution. However, as was the case with the Hanshin-Awaji earthquake³, people in areas affected by the Great East Japan Earthquake had no way of accessing such information in the early days after the disaster. Some shelters had televisions, but these were not used because of electricity shortages. Mobile phone communication was disrupted or unstable, and, needless to say, newspapers were not available. Even when mass communication was restored, the elderly often did not know how to use the Internet. Realistically, the most useful method of communication at that time was a written notice posted on a notice board in

Table 1 | Coping with matters affecting diabetic patients after a disaster

- Do not panic.
- Gather specific information regarding the circumstances that you are in.
- For patients with type 1 diabetes, insulin injections are indispensable. Do not discontinue insulin injections. You might have to change the amount and timing of the insulin injections, depending on your situation.
- For patients with type 2 diabetes, try to continue ordinary treatment. However, the treatment can be modified, if necessary.
- You might need to keep your blood glucose level relatively high to avoid hypoglycemia.
- Drink sufficient liquids to avoid dehydration.
- Be aware that the supplied food might often be high in calories and might contain large amounts of salt.
- Try to perform simple exercises.
- Prevent infection by wearing a mask, gargling and washing your hands. Wear gloves and shoes with thick soles to avoid injury when working outside.
- Do not endure your worries or anxieties by yourself. Find someone you can consult. Sometimes, you might need counseling by a specialist.

front of the public health center. Therefore, we should consider practical means of distributing required information in various situations. Second, guidelines and manuals for both diabetic patients and healthcare providers need to be created for the various situations that occur in the event of a natural disaster. Although a few such guidelines and manuals are already available, the situations often vary, and several guidelines are required to cover these different conditions. Manuals for the prescription of antidiabetic agents, in particular, would be useful, especially for doctors who are not specialized in diabetes. Third, patients should be educated beforehand as to what to do and how to prepare for possible disasters (Table 1), and each of the various situations that might be encountered should be covered. Lectures regarding these issues should be included in educational classes for diabetic patients organized by medical institutions.

In July 2012, 1 year and 4 months after the disaster, we revisited the affected areas and found that debris and rubble were still piled up, and destroyed houses had remained untouched in some places. A great deal of time will be required for the entire region to recover from this disaster. We should not waste our experience, and we do hope what we learned from this experience will be of practical use in the future.

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