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Infectious waste management in Japan: A revised regulation and a management process in medical institutions

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Abstract

In Japan, the waste management practice is carried out in accordance with the Waste Disposal Law of 1970. The first rule of infectious waste management was regulated in 1992, and infectious wastes are defined as the waste materials generated in medical institutions as a result of medical care or research which contain pathogens that have the potential to transmit infectious diseases. Revised criteria for infectious waste management were promulgated by the Ministry of Environment in 2004. Infectious waste materials are divided into three categories: the form of waste; the place of waste generation; the kind of infectious diseases. A reduction of infectious waste is expected. We introduce a summary of the revised regulation of infectious waste management in this article.

1. Introduction

The waste management practice in Japan is performed in accordance with the Waste Disposal and Public Cleansing Law (the Waste Disposal Law) of 1970. Medicines, equipment, instruments and food are used while treating in-patients and out-patients at hospitals and clinics, producing a variety of waste materials. Waste materials generated at hospitals and clinics (medical institutions) are divided into infectious and non-infectious. The waste generated from the treatment of patients suffering from infectious diseases may spread infection either through direct contact or indirectly through the environment. Transmission of infectious diseases is a serious matter. Therefore, an appropriate waste management system is essential. The World Health Organization (1983), US Environmental Protection Agency (1986, 1991), US Centers for Disease Control and Prevention (1978), Germany (Muhlich et al., 2003; The Ministry of Environment, 2004), and many other countries have already established strict guidelines for the management of infectious waste materials disposed of from medical institutions.

In Japan, the first regulation focusing on all medical facilities, such as, hospitals, clinics, laboratories and animal clinics, was promulgated in 1992. The management of infectious waste materials was regulated in 1992 under the amended Waste Disposal Law of 1991. However, troublesome problems on management practices of infectious waste materials in medical institutions have been recognized by the agencies concerned (Miyazaki, 2001, 2003; Miyazaki and Une, 2004a). In fact, medical institutions have faced difficult problems at many places regarding the treatment and disposal of infectious waste in practice. Furthermore, many articles reported technologies of disinfection methods in medical institutions (Haishima, 2000; Matsumoto, 2000; Takatsuki, 2000; Murata et al., 2004) and reports about a management system of infectious waste are rare (Hayashi and Shigematsu, 2000; Miyazaki, 2001, 2003).

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The Waste Disposal Law was amended in 2003 and the revised regulation including new criteria for the infectious waste management was provided in 2004 by the Ministry of Environment. The purpose of this study was to introduce the new criteria and a summary of the revised regulation about the management of infectious waste materials for medical institutions in Japan.

2. Definition of infectious waste in medical institutions

The management of hazardous waste is one of the most important problems in medical institutions (Naito, 1987) and infectious waste is one category of hazardous waste. Infectious waste materials need to be handled with careful consideration to prevent the spread of pathogens and to protect environmental health, in addition to being segregated from other waste materials.

In the amended Waste Disposal Law of 1991, infectious wastes are defined as the infectious waste materials generated in medical institutions as a result of medical care or research which contain pathogens that have the potential to transmit infectious diseases. Infectious waste materials disposed from medical institutions have been regulated since 1992. Infectious waste materials become non-infectious after they have lost infectivity by an intermediate treatment, such as incineration, melting or sterilization, and they are buried in a landfill.

3. Criteria in a revised guideline

Waste disposed of from medical institutions is divided into infectious and non-infectious. Characteristics of infectious waste materials are classified into the form of waste, the place of waste generation, and the kind of infectious disease. Infectious waste is defined as follows in the revised guideline (Fig. 1):

1. Form of waste. The following waste materials are defined as infectious waste:
   (1) Blood and body fluids.
   (2) Tissues, organs and body parts.
   (3) Sharp objects contaminated with blood and body fluids.
   (4) Test equipment and cultures of infectious agents. Infectious waste materials include cultures of infectious agents from laboratory work. These waste materials include human tissues, organs, body parts, and other items, like cotton battings contaminated with blood and body fluids. Waste materials disposed of from veterinary clinics are also included in infectious waste.

2. Place of waste generation. Waste materials disposed of from a room mentioned below are defined as infectious waste: a ward for infectious diseases; an operating room; an emergency room for out-patients; an intensive care unit; an inspection room such as a pathological and a biological laboratory and an autopsy room. Infectious waste is all materials used for the treatment and examination of patients in these rooms.

3. Kind of infectious disease. Waste materials relating to infectious diseases which are enumerated below are defined as infectious waste:
   (1) Infectious diseases of group 1–3 determined in the law concerning Prevention on Infectious Diseases and Health Care for Patients of Infectious Diseases (the Infectious Diseases Law) (Table 1); Infectious waste is all materials used for the treatment and examination of patients with infectious diseases in Table 1.
   (2) Tuberculosis. Infectious waste is all materials used for the treatment and examination of patients with tuberculosis.
   (3) Infectious diseases of group 4 and 5 determined in the Infectious Diseases Law (Tables 2 and 3).

Infectious waste is materials used for the treatment and examination of patients with infectious diseases in Tables 2 and 3. Materials are cotton battings, cotton dressings and gauzes (sanitary materials), and disposable equipment contaminated with bloods and body fluids.

In a case in which the persons concerned cannot readily determine whether the was is infectious, the decision is made by a physician. Not only waste materials with sharp-edges, like injection needles, but also those that become sharp objects when broken, such as ampoules, handled as infectious waste from the viewpoint of mechanical hazard, even though the waste materials may be non-infectious.

4. Discussion

Waste management is carried out in Japan in accordance with the Waste Disposal Law of 1970. Waste materials are classified as industrial and general-household (municipal wastes): industrial waste materials generated as a result of industrial activities and general-household waste materials, referred to as waste materials other than industrial waste. Infectious waste materials disposed from hospitals and clinics are defined as industrial waste, and infectious waste materials are also categorized as one type of hazardous waste material (Naito, 1987). The management of hazardous waste is one of the most important problems in medical institutions (Abatemarco et al., 1995; Ostry et al., 1995; Almuneef and Memish, 2003). A revised regulation was needed with a clear and precise definition of infectious waste is essential, because
The criteria in the former regulation were only a form of waste (the Ministry of Health and Welfare, 1992) and infectious waste needs to be handled carefully and strictly to prevent the spread of pathogens and to protect environmental health. The waste generated from the treatment of patients suffering from infectious diseases may spread infection either through direct contact or indirectly through the environment. The management of these infectious waste materials was regulated in 2004 under the Waste Disposal Law of 2003.

All wastes including infectious waste disposed off from medical institutions are termed medical waste in Japan. Medical waste is, however, not defined in the Waste Disposal Law of 2003. In addition, radioactive medical waste is regulated in the Radioactive Prevention Law of 1958 by the Science Technology Agency.

Table 1
Infectious diseases categorized into group 1, group 2 and group 3

| Group 1          | Group 2          | Group 3          |
|------------------|------------------|------------------|
| Crimean-Congo hemorrhagic fever | Ebola hemorrhagic fever | Lassa fever |
| Marburg disease smallpox          | Plague           | Severe Acute Respiratory Syndrome (SARS) |
| Acute poliomyelitis               | Cholera          | Diphtheria       |
| Paratyphoid fever                 | Shigellosis      | Typhoid fever    |
| Enterohemorrhagic Escherichia coli infection |                      |                  |

From the Japanese law concerning Prevention on Infectious Diseases and Health Care for Patients of Infectious Diseases of 2003. Group 1 is the most pathogenic group.
Therefore, the new regulation focuses on an appropriate management system of infectious waste, and radioactive medical waste is not addressed in this one. Furthermore, infectious waste materials are not recyclable (Miyazaki and Une, 2001).

In accordance with this new regulation, waste materials with sharp-edges are collected and segregated from other wastes to prevent injury. Sharp objects also include both unused sharp objects and disinfected sharp ones, such as a scalpel. Sharp objects need to be put in a tight container, such as a can, with a lid so as not to injure the persons concerned. Needle-prick accidents have been reported by approximately 30% of municipal governments (Miyazaki and Une, 2004b). Therefore, such segregation is based on the treatment of infectious waste materials requiring special care. A container including sharp objects is never opened and it is transported to a waste incinerator which is authorized by a prefectural government.

Table 2
Infectious diseases categorized into group 4

| Group 4                        | Acquired immunodeficiency syndrome | Anthrax                      | Avian influenza virus infection | Botulism                      |
|--------------------------------|------------------------------------|-----------------------------|--------------------------------|-------------------------------|
| Congenital rubella syndrome    | Congenital rubella syndrome         | Anthropophthysis            | Creutzfeldt-Jacob disease      | Cryptosporidiosis              |
| Giardiasis                     | Giardiasis                          | Severe invasive streptococcal infections | Severe invasive streptococcal infections | Syphilis                      |
| Meningococcal meningitis       | Meningococcal meningitis            | Tetanus                     | Tetanus                        | Vancomycin-resistant Enterococcus infection |
| Vancomycin-resistant Streptococcus aureus infection | Vancomycin-resistant Streptococcus aureus infection | Viral hepatitis (excluding hepatitis A and E) | Viral hepatitis (excluding hepatitis A and E) | Vancomycin-resistant Enterococcus infection |
| Influenza                      | Influenza                           | Chickenpox                 | Chickenpox                    | Erythema infection             |
| Exanthem subitum               | Exanthem subitum                    | Group A streptococcal pharyngitis | Infectious gastroenteritis | Hand, foot and mouth disease |
| Herpes B virus infection       | Herpes B virus infection            | Rubella                    | Pertussis                      | Measles                        |
| Legionellosis                  | Legionellosis                       | Conjugate typhus            | Conjugate typhus               | Pharyngitis conjunctivitis     |
| Lymphocytic infiltration       | Lymphocytic infiltration            | Gonorrhea                  | Gonorrhea                      | Genital chlamydial infection   |
| Poxvirus infection             | Poxvirus infection                  | Chlamydial pneumonia (excluding psittacosis) | Chlamydial pneumonia (excluding psittacosis) | Aseptic meningitis             |
| Methicillin-resistant Streptococcus aureus infection | Methicillin-resistant Streptococcus aureus infection | Multi-resistant Pseudomonas aeruginosa infection | Multi-resistant Pseudomonas aeruginosa infection | Penicillin-resistant Streptococcus pneumonia infection |

From the Japanese Law concerning Prevention on Infectious Diseases and Health Care for Patients of Infectious Diseases of 2003.

Table 3
Infectious diseases categorized into group 5

| Group 5                        | Acquired immunodeficiency syndrome | Anthrax                      | Avian influenza virus infection | Botulism                      |
|--------------------------------|------------------------------------|-----------------------------|--------------------------------|-------------------------------|
| Congenital rubella syndrome    | Congenital rubella syndrome         | Anthropophthysis            | Creutzfeldt-Jacob disease      | Cryptosporidiosis              |
| Giardiasis                     | Giardiasis                          | Severe invasive streptococcal infections | Severe invasive streptococcal infections | Syphilis                      |
| Meningococcal meningitis       | Meningococcal meningitis            | Tetanus                     | Tetanus                        | Vancomycin-resistant Enterococcus infection |
| Vancomycin-resistant Streptococcus aureus infection | Vancomycin-resistant Streptococcus aureus infection | Viral hepatitis (excluding hepatitis A and E) | Viral hepatitis (excluding hepatitis A and E) | Vancomycin-resistant Enterococcus infection |
| Influenza                      | Influenza                           | Chickenpox                 | Chickenpox                    | Erythema infection             |
| Exanthem subitum               | Exanthem subitum                    | Group A streptococcal pharyngitis | Infectious gastroenteritis | Hand, foot and mouth disease |
| Herpes B virus infection       | Herpes B virus infection            | Rubella                    | Pertussis                      | Measles                        |
| Legionellosis                  | Legionellosis                       | Conjugate typhus            | Conjugate typhus               | Pharyngitis conjunctivitis     |
| Lymphocytic infiltration       | Lymphocytic infiltration            | Gonorrhea                  | Gonorrhea                      | Genital chlamydial infection   |
| Poxvirus infection             | Poxvirus infection                  | Chlamydial pneumonia (excluding psittacosis) | Chlamydial pneumonia (excluding psittacosis) | Aseptic meningitis             |
| Methicillin-resistant Streptococcus aureus infection | Methicillin-resistant Streptococcus aureus infection | Multi-resistant Pseudomonas aeruginosa infection | Multi-resistant Pseudomonas aeruginosa infection | Penicillin-resistant Streptococcus pneumonia infection |

From the Japanese Law concerning Prevention on Infectious Diseases and Health Care for Patients of Infectious Diseases of 2003.

Therefore, the new regulation focuses on an appropriate management system of infectious waste, and radioactive medical waste is not addressed in this one. Furthermore, infectious waste materials are not recyclable (Miyazaki and Une, 2001).

In accordance with this new regulation, waste materials with sharp-edges are collected and segregated from other wastes to prevent injury. Sharp objects also include both unused sharp objects and disinfected sharp ones, such as a scalpel. Sharp objects need to be put in a tight container, such as a can, with a lid so as not to injure the persons concerned. Needle-prick accidents have been reported by approximately 30% of municipal governments (Miyazaki and Une, 2004b). Therefore, such segregation is based on the treatment of infectious waste materials requiring special care. A container including sharp objects is never opened and it is transported to a waste incinerator which is authorized by a prefectural government.

With respect to storage, all infectious waste materials are segregated from other wastes in special storage areas to prevent the spread of infection in medical institutions. A hermetically tight container is used and a notice indicating the type of infectious waste materials is attached to the container. Each label is colored based on the type of waste: labels for blood and body fluids are red, solid materials are orange, and sharp objects are yellow. A regular cart is used for transportation of a container to reduce a risk of direct contact and contamination in medical institutions. A container including infectious waste materials is kept in the special storage areas for the shortest period of time possible and no one except the persons concerned is permitted to enter the storage areas. A sign stating “infectious waste” is posted to be easily visible in each storage area.

As regards the disposal practice from medical institutions, a medical institution contracts with specified businesses that are authorized by a prefectural government.
for collecting, transporting and incinerating infectious waste materials. All infectious waste materials have to be segregated from other wastes. Waste workers of a medical institution collect all infectious waste materials from special storage spots and transport them to a restricted place where a special infectious waste business (contractor) collects them. Waste workers wear gloves and a mask while at work. A contractor directly transports infectious waste materials to an incinerator which is authorized by a prefectural government, and these wastes materials are burnt by more than 800 °C soon after collection.

In Japan, because infectious waste materials disposed of from medical institutions are not collected and transported by the municipal governments, a medical institution is responsible for the associated expense. Each medical institution, therefore, must contract a specified business authorized by a prefectural government for the treatment of infectious waste, and disposal cost is becoming a serious matter. The collection and transportation price is determined by the quantity of waste, transportation distance and frequency, a container price, and an incineration price.

A contractor specifies a container which a medical institution must use. The standard of containers was regulated in 1995 under the Waste Disposal Law of 1991. It is estimated that Yen 400–800 (US$1 = Yen 110)/20 L container or Yen 100–150/kg of infectious waste is a typical cost (Miyazaki, 2001). However, not all medical institutions have obtained accurate information on each infectious waste handling business including their qualities (such as the number of years dealing in infectious waste and the existence of violations) and a treatment price. A contract with a dishonest business induces a cost for handling of infectious waste for as little as Yen 100 or less (Miyazaki, 2001). In such a case, illegal dumping often occurs. To prevent the illegal dumping of infectious waste materials; An information network needs to be established by the cooperative harmony of the stakeholders including the Ministry of Environment.

The manager of a medical institution is obligated to educate the persons concerned, such as medical, health care and hospital waste workers, about the treatment of infectious waste. A control manager handling infectious waste should institute an education program and prepare a plan for the reduction and disposal methods of infectious waste materials, because cost-effective management is needed (Byeong-Kyu et al., 2004). The most important outcome of the infectious waste management plan is to convince medical care workers that the plan is safe and has a significant benefit for the medical institution. In addition, the support of the administration division is also indispensable for ensuring the success of the management plan.

To reduce infectious waste materials, the segregation of waste in a medical institution must be strictly performed and non-infectious waste materials must not be disposed of as infectious waste, because a reduction of infectious waste results in a reduction of disposal costs. Intensive education on proper infectious waste procedures should be provided through lectures, posters, and handouts. In addition, various reusable items, such as linens, should be positively utilized to reduce infectious waste materials. Both the education of personnel concerned (including medical staffs and waste workers) and accurate information on special infectious waste businesses are indispensable to appropriately treat and dispose of infectious waste. Moreover, monitoring workers’ compliance and direct feedback of information, such as a disposal cost and a quantity of infectious waste, are also considered essential for the continued success in reducing infectious waste materials. The potential for causing infection varies greatly depending on the sharpness and quality of waste. Strict adherence to the revised regulation by medical institutions can thus protect waste workers from being infected.

5. Conclusion

This paper is a summary of the revised regulation for infectious waste management in Japan. Infectious waste must be managed in accordance with the Waste Disposal Law of 2003 and the rules promulgated in 2004 by the Ministry of Environment. Infectious waste materials are to be collected and segregated from other wastes, and transported to incinerators where they are combusted by a special waste handling business with which a medical institution contracts. Disposal costs are, however, becoming expensive. Therefore, medical institutions should make every effort to reduce infectious waste generated in their facilities. Due to the increase in the quantity and to the diversified quality of waste materials disposed of from medical institutions, the management of such materials has become increasingly important in order to protect waste workers from infection. The revised regulation is expected to encourage the reduction of infectious waste and to protect waste workers from being infected.

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