(6) If a victim does not have a pulse
An AED is used for a victim who is in a cardiopulmonary arrest and whose heartbeat does not restart after cardiopulmonary resuscitation (CPR). An electric shock is applied for defibrillation.
[Effectiveness]
It is important to perform defibrillation using an AED as soon as possible. The life-saving effect is considered to drop by 7% or 8% for each minute of delay in defibrillation. The prognosis of a victim depends largely on the quickness of the use of an AED.
[Usage]
[1] Place the AED next to the victim at a position that does not obstruct the person who performs chest compressions.
[2] Turn on the AED and follow the audio prompts. (Continue CPR even after arrival of the AED.)
1) Attach electrode pads and connect cables.
2) The electrocardiogram (ECG) signals are analyzed.
3) Press the “shock” button upon a prompt to start defibrillation (electric shock). Take care to avoid an electric shock to yourself. Perform chest compressions upon a prompt that defibrillation is not required.
[3] Resume CPR immediately with the electrode pads attached. ECG signals are analyzed two minutes later. If the victim regains consciousness or voluntary respiration is confirmed, discontinue chest compressions and observe the victim carefully.

* The AED arrangement plan can be checked on the website of the Kumamoto University Health Care Center (in Japanese, http://hcc.kumamoto-u.ac.jp/) → “健康相談 (Health Consultations)” → “健康の手引き (Health Guidance).”

2. Emergency measures

Emergency measures also include first-aid measures, but this section focuses on fire, explosion, and leakage attributed to chemical substances. When handling hazardous materials and toxic chemical substances, fire or explosion may occur due to ignition and inflammation. Such materials and substances may adhere to the body, clothes, etc. When toxic chemical substances are dropped, etc., they may spread over a table or floor. In these cases, it is important to take action properly to prevent the damage from spreading. For details of the method of taking action for respective chemical substances, make sure to refer to SDSs.

(1) Fire caused by ignition and inflammation
If a fire breaks out, let other people know about the fire in a loud voice without hesitation and call for support. Also call for a firefighting team and contact the gate house and the Accident Prevention Center. If there are injured persons, rescue them first. Next, start first-aid fire fighting using a fire extinguisher (powder: for ABC fires) and fire extinguishing sand (alkaline metal: for fires caused by potassium and sodium). It should be noted that first-aid fire fighting using a fire extinguisher and fire extinguishing sand is effective only to a certain extent. If the flame is as tall as a person, evacuate immediately. Avoid inhalation of smoke during evacuation.
[Notes]
1) In such cases, completely stop the experiment and the use of gas or fire to prevent a secondary accident.
2) In the event of a fire, close the windows of the room (to prevent the fire from spreading).
3) If the face is burned due to an explosion, etc., check whether nose hair has been singed. If nose hair is singed, the victim may have suffered respiratory burns. Take the victim to a hospital promptly.
4) If clothes catch fire, drop and roll to extinguish the fire. Or, roll the victim or use a piece of cloth or water, etc. to extinguish the fire.

(2) Leakage of toxic chemical substances
If a toxic chemical substance is dropped, etc. and spreads over a table or floor, open the windows of the room immediately for ventilation. Let other people know about the leakage and restrict access to the room. Next, wear gloves and wipe off the chemical substance while minimizing inhalation. Put the rags and towels used to wipe off the chemical substance in a polyethylene bag and seal the bag. If the chemical substance is likely to melt a polyethylene bag, put the rags and towels in a polyethylene bucket, etc. and close the cap.

In the case of spillage of an organic solvent or specified chemical substance in a large quantity, contact the health supervisor of the Operation Site or the Safety Support Office of the Environmental Safety Center (ext. 3234).

In the event of effluence of a toxic chemical substance (e.g., discharge into a sink by mistake), stop using water of such facility immediately and contact the Safety Support Office of the Environmental Safety Center. To avoid effluence off campus, let other people know about the effluence and stop wastewater that flows into the storage tank of such facility. If wastewater cannot be stopped, stop water supply.

The methods of taking action for frequently used chemical substances are explained below.

(1) Acids
Many acids are highly corrosive and cause chemical damage when they enter the eyes. Loss of sight may result in the worst case. Gases generated by concentrated hydrochloric acid, concentrated nitric acid, fuming sulfuric acid, etc. corrode the respiratory tract. Ingestion also corrodes tissue. It is necessary to take care in handling. For acids, the basic action to take is as follows.

1) If an acid adheres to the body (e.g., skin), clean the contaminated area with water immediately.
2) If an acid adheres to clothes, clean the clothes with water. Neutralize the acid with sodium carbonate or sodium bicarbonate, etc. and wash the clothes again with water.
3) If an acid spills onto the floor, etc., dilute it with water and neutralize it with sodium bicarbonate or lime before wiping it off.

The heat of dilution of sulfuric acid is high. When diluting sulfuric acid, add sulfuric acid little by little into a large amount of water. When sulfuric acid is simply diluted, it condenses into concentrated sulfuric acid as the water content evaporates. Corrosivity increases again. Sufficient cleaning and neutralization are required.

Hydrofluoric acid is another strong acid. Hydrofluoric acid erodes silicates (e.g., glass) and dissolves most metals other than gold and platinum. Thus, hydrofluoric acid is used for etching, etc. but is highly toxic to the human body and is highly corrosive. It penetrates into the cellular tissue and causes gangrene. Its vapor is also toxic. Make sure to provide protection to prevent adhesion to skin and clothes, etc. Use a gas mask. If hydrofluoric acid adheres to the skin, clean the contaminated area and apply calcium gluconate.

(2) Alkalis

Many alkalis are highly corrosive. They decompose protein and destroy tissue. Ingestion may open holes in internal organs. They cause chemical damage when they enter the eyes. Loss of sight may result in the worst case. As in the case of acids, gases generated by alkalis corrode the respiratory tract. It is necessary to take precautions. For alkalis, the basic action to take is as follows.

1) If an alkali adheres to the body (e.g., skin), clean the contaminated area with water immediately. If the slippery feel cannot be removed, clean the contaminated area with diluted acetic acid of about 1% (diluted vinegar is also acceptable) and clean the contaminated area with water again.
2) If an alkali adheres to clothes, clean the clothes with water. Neutralize the alkali with diluted acetic acid of about 1%, etc. and wash the clothes again with water. If ammonia adheres to the clothes, it is acceptable to wash the clothes sufficiently only with water.
3) If an alkali spills onto the floor, etc., dilute it with water and neutralize it with diluted acetic acid of about 2% before wiping it off.

Solutions of strong bases, such as sodium hydroxide and potassium hydroxide, corrode various metals and generate hydrogen. Their heat of dissolution is high. Thus, bumping may occur. Vapors generated by heat are also hazardous. Dissolve such alkalis little by little.

Ammonia is a highly volatile alkali. It is necessary to take precautions against the gases generated by ammonia.

(3) Organic solvents

Many organic solvents are highly volatile and flammable, as discussed in the sections about the use of hazardous materials, specified chemical substances, and organic solvents. It is necessary to take precautions against their vapors. Only some organic solvents have strong acute toxicity, but many have strong chronic toxicity caused by long-term exposure. Thus, they must be handled carefully. Basically, organic solvents must be used in a fume hood. Take the following action.

1) If an organic solvent adheres to the body (e.g., skin), clean the contaminated area using soap immediately.
2) If an organic solvent adheres to clothes, clean the clothes using soap.
3) If an organic solvent spills onto the floor, etc., keep ignition sources away and ventilate the room and wipe it off using a cloth (e.g., cleaning rag) or paper, etc.

Vapors of organic solvents are also absorbed by the skin. Protect the skin as much as possible.

Some experimenters wipe off an organic compound that adheres to the skin using an organic solvent. Remember that organic solvents penetrate into the skin tissue. The use of an organic solvent to wipe off an organic compound may result in penetration deep into the skin. Basically, clean the skin using soap.

Conclusion

Management of chemical substances means to minimize and control the damage caused by toxicity and hazards of chemical substances. At Kumamoto University, the Superior Committee for Safety and Health deliberates campus-wide safety and health measures. It has a subsidiary body named the Special Committee for Management of Chemical Substances to study and plan management of chemical substances. The special committee discusses how to manage chemical substances, monitor the status, and offer education, etc. The University Rules stipulate that the Manager of each Group is responsible for management of chemical substances.

At Kumamoto University, the Environmental Safety Center (an on-campus joint education and research facility), health supervisors of respective Operation Sites, and Safety and Health Management Teams of the Facilities Management Division (Facilities Department) fulfill the duty to support management of chemical substances.

It should be noted that the University has about 250 Groups that handle chemical substances. It is difficult for the above organization and human resources alone to support the entire management of chemical substances. Safety in education and research cannot be ensured without cooperation from Chemical Substance Managers and all individuals who handle chemical substances.

Against this backdrop, this manual was prepared for education about handling of chemical substances. The manual was edited by the Special Committee for Management of Chemical Substances. The manual is still incomplete. It will be improved gradually. If you have comments, advice, etc. regarding this manual, send an email to the administrative personnel (chemical@jimu.kumamoto-u.ac.jp) of the Special Committee for Management of Chemical Substances.

Best wishes for safe experiments.

March 2018

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