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Laboratory Safety

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"Laboratory safety" is important in laboratory medicine. The basic principle of work in laboratory must be followed. Five types of hazards encountered in a clinical laboratory and a list of safety procedures (laboratory hygiene, sharps safety, safety equipment, fire safety and chemical safety) are designed to avoid or minimize them are identified. Laboratory safety for each category is hereby presented.

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ความปลอดภัยในห้องปฏิบัติการเป็นสิ่งที่มีความสำคัญทางเวชศาสตร์ชันสูตร หลักข้อบังคับเบื้องต้นของห้องปฏิบัติการมีความจำเป็น มีกลุ่มของภยันตรายหลัก ๆ 5 ประการที่จำเป็นต้องได้รับการจัดการด้านความปลอดภัย (สุขอนามัยห้องปฏิบัติการ, การจัดการของมีคม, การจัดหาเครื่องป้องกัน, การจัดการอัคคีภัย และการจัดการสารเคมี) เพื่อลดความเสี่ยงและหลีกเลี่ยงอุบัติการณ์รายละเอียด แต่ละประเด็นได้อภิปรายไว้ในบทความนี้

คำสำคัญ: *ห้องปฏิบัติการ, ปลอดภัย*

"Laboratory safety" is important in laboratory medicine. "Laboratory safety" is a major aspect of every lab-based science class. "Laboratory safety" rules and symbols are needed so that practitioners do not injure themselves or their friends. Laboratory safety is a major concern to scientific personnel conducting research or safety testing, laboratory directors are responsible for institutional liability for employees, and to any personnel work or reside near the laboratory. [1] The basic principle of working in laboratory must be followed. The principle is easy but usually forgotten. The principles include: a) no eating or drinking in labs; b) cleanse body and workspace after use; c) ensure that no trash is left behind; d) push in chairs and place laboratory items back on carts and trays. More details on specific aspects of laboratory safety will be further discussed in this article.

Laboratory safety

Five types of hazards encountered in a clinical laboratory and a list of safety procedures designed to avoid or minimize them are identified. Laboratory safety for each category is hereby presented.

1. Laboratory hygiene

Laboratory hygiene is a basic concept for laboratory safety. The recommendations for laboratory hygiene include: a) scrub hands; b) avoid cross contamination; c) do not touch self, faucets, doorknobs, notebooks, pens etc. with gloves on; and, d) cleanse and disinfect workspace. As previously mentioned, eating, drinking, or chewing gum in the laboratory must be avoided. Do not use lab glassware as food or beverage containers. At present, it is attempted to indicate the development of safety standards concerning biotechnology. [2] Indeed, this development is in a state of flux.[2] In addition, the finding that the risks in handling DNA organisms are not larger than those arising when handling the known pathogens is presently more accepted.[2] Furthermore, laboratory building is designed to maintain life safety, industrial hygiene, and accident prevention is also presently discussed topic. [3]

2. Sharps safety

One key element of laboratory safety precautions related to the safe handling and management of sharp objects to prevent occupational acquisition of blood-borne viral infection. [4] In a laboratory, sharp objects including razor and scalpel blades, needles and pins, microscope cover slips and broken glass. The main safety is set so that no sharp objects or glass in the trash. Sharp objects must be placed in sharp boxes and broken glass must be left into a glass box. Many inoculation injuries could be avoided by following standard precautions whenever contact with blood or body fluids is anticipated.[4] However, evidence suggests that compliance with standard precautions is inadequate.[4] Elder and Paterson reported sharps injuries in UK health care. [5] According to their work, Elder and Paterson concluded that although injuries remained common, confirmed viral transmission in the UK was relatively rare. Elder and Paterson also mentioned that the degree of under-reported sharps injuries might be as much as 10-fold.[5] They concluded that safety-engineered devices are likely to be effective for injury reduction.[5] A specific process for developing, assessing, or revising a sharps safety program should be proposed for each laboratory. [6-7]

3. Safety equipment

Safety equipment is useful therefore it is a basic rule to use safety equipment. There are many kinds of safety equipment in laboratory such as needle stick prevention equipment, shower and eyewash, and alarm pulls. As for medical laboratory the risk of occupational transmission of blood-borne pathogens related to sharp devices remains a significant hazard to both healthcare and related workers.[8] Previously, education, training, universal precautions and hepatitis B vaccination have been implemented in an attempt to reduce the risks.[8] However, the most recent preventive strategy is needle-protective devices.[8] In USA, the Needle-stick Safety and Prevention Act of 2000 was signed into law and safety equipment is a basic requirement for medical laboratory.[9] Tuma and Sepkowitz reported that safety-engineered devices were an important component in percutaneous injury prevention. [9] Design for facilities for laboratory is also necessary. Kuehne said that a laboratory suite for infectious disease studies had to be contained within a larger research facility; separate biological safety cabinet systems, animal rooms that support laboratories, change room facilities, shower, air lock, and other safety features should be contained in the area. [10]

4. Fire safety

Three elements are needed for a fire to start and flourish: heat, fuel, and oxygen. [11] These elements form the three sides of the 'fire triangle', and the removal or isolation of any one will extinguish a fire.[11] Such action forms the basic of fire fighting techniques currently in use by the fire authorities.[11] In the USA, the National Fire Protection Association, Quincy, Mass, estimated that each year 169 fires occurred in healthcare, medical, and chemical laboratories.[12] According to the report, there are estimated 13 civilian injuries and 1.5 million dollars per year in direct property damage.[12] Basic principles for prevention of fire in laboratory include: a) never leave flames unattended; b) do not use flammables near ignition sources; c) fire extinguishers and fire blanket made available; and, d) fire alarm pulls equipped. Future researches should focus on laboratory materials and aim to reduce the flammability of such items in the laboratory room.[13] Hoeltge *et al.* stated that fire preparedness would be improved if all clinical laboratories had smoke detectors and automatic fire-extinguishing systems.[12] In addition, in-service training courses in fire safety should be targeted to the needs of specific service areas. [12]

5. Chemical Safety

There are many kinds of chemical hazards in laboratory (Table 1). For chemical safety, wear gloves and glasses where appropriate. Following laboratory's directions is required when performing a chemistry test in laboratory. In addition, dispose of waste properly and do not pour down untreated chemical into the drain.

Accident in laboratory

Accidents and injuries are totally unwanted in laboratory. However, they can be detected. It is a basic rule to report all accidents to laboratory risk manager immediately, even if you think it is minor.

A. Needle stick injury

In laboratory, needle stick injury can be seen but less often than that of specimen collection units and wards.[14] Two handed recapping of used needles

Table 1. Chemical Hazards.

Chemical Hazards	Details
1. Flammable	Any substance that will burn if exposed to an open flame.
2. Explosive	A substance that may explode if exposed to heat or flame.
3. Toxic/Poison	A substance that can lead to death if inhaled, ingested, or absorbed by the skin.
4. Corrosive	A substance that can destroy or burn living tissues and can eat away at other materials.
5. Irritant	A substance that causes inflammation upon contact with skin or mucous membranes.
6. Environmental	Substances that are harmful to the environment. They must be disposed of properly, not washed down the drain.

is the main cause of needle stick injury. Specific equipment should be used for protection as described in sharps safety.

B. Eye accident

When eye accident occurs, wash the eye with copious amount of water for at least 15 minutes. The hazards can be both bio - or chemo - hazards. Goggles or safety glasses are recommended. [15-16] In addition, protection for radiation should also be concerned. It is shown that such spectral protection is now available in plastic lenses, but care must be taken to insure that the plastic has the required ultraviolet and near-infrared absorption.[17] Eye protection standards must be improved. [17]

C. Burns

In case of fire burns, the management must be stopped, dropped, and be covered with a fire blanket or soaked with water. Do not remove clothing stuck to victim and get medical attention immediately. Flammable and combustible liquids should be controlled, and particular warnings should be given concerning the fire and explosion risks associated with diethyl ether, diisopropyl ether and xylene in medical laboratory. [18]

Word area implementation plan

Word area implementation plan is not required but highly recommended. It is useful for reduction of legal and regulatory liability and proof of training compliance.

A. Basic implementation plan

The first step should start from commitment to safety and health. Laboratory location analysis must be performed and responsible persons should be set. The training ocumentation must be designed. Hazard warnings, hazard identification and labeling have to be performed in this phase.

B. Laboratory safety plan

Strategies for minimizing exposure including engineering controls, administrative controls and protective equipment must be set. Laboratory safety rules and procedures must be launched for

practitioners. Another important part to be concerned is waste disposal. Proper waste disposal must be set because hazardous chemicals washed down the drain can lead to pollution of ground water and plants and animals will die if they are exposed to hazardous chemical waste. In addition, serious health problems will become present in people if hazardous waste finds its way into drinking water.

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