

SAFETY AND FIRST AID IN LABORATORY – A BRIEF OUTLINE

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ABSTRACT

Safety is an important aspect of any clinical laboratory. Every clinical laboratory must have a formal safety program to ensure a safe and healthy working environment^(1, 2). Safety should be the code of practice and it involves discipline in addressing the safe handling and containment of various hazardous materials in a laboratory⁽³⁾. It is a joint responsibility of both management and laboratory workers and the duty of the management is to establish and maintain adequate standards, policies, procedures, work practices and maintenance of buildings and equipment. On the other hand, it is the responsibility of the laboratory workers to understand and adopt good laboratory practices to achieve a healthy working environment. A safe lab, in addition to protecting laboratory workers, also helps to protect the environment and public from exposure to hazardous materials⁽³⁾. This article addresses the various hazards encountered in a laboratory, its management, and the importance of safety program in a clinical laboratory set up.

Keywords: Laboratory Safety, Universal Precautions, OSHA, Laboratory hazards, First aid

INTRODUCTION

The first step towards safety regulations for clinical laboratories was initiated by OSHA(Occupational Safety and Health Administration) and CDC(Centre for Disease Control and prevention) in 1970 when they published numerous safety standards in a clinical set up⁽¹⁾. Later in 1988, OSHA expanded the hazard communication standard to apply to hospital workers, which is frequently referred to as the “lab right to know standard”⁽¹⁾. They insisted that management should be committed to safety of its employees and it should increase health and safety awareness among employees through proper educational programs.

HAZARDS

Hazards in a clinical laboratory can be broadly classified into chemical hazards, electrical hazards, fire hazards & bio-hazards.

CHEMICAL HAZARDS AND ITS MANAGEMENT

Common chemical hazards found in a lab are Explosives, Compressed gases, Flammables, Oxidizers, Toxic materials, and Corrosive materials⁽⁴⁾.

FLAMMABLES: Substances which have a flash point or ignition point below room temperature. E.g. Oil and Gasoline, Ether etc. Storage rooms, cabinets and containers should be specially designed for such flammable liquids.

COMBUSTIBLES: Flash point at or above room temperature. It is better to choose a combustible product over a flammable product if all other considerations are equal. Clearing agents offer this choice.

EXPLOSIVES: Picric acid forms dangerous salts with certain metals which explode when wet ⁽⁵⁾. Avoid them altogether. Certain silver solutions, on ageing, explode by shaking. So never store these solutions after use.

OXIDATIVES: Oxidatives promote combustion in other materials, but are harmless themselves. They have a risk of fire hazard when in contact with suitable material. E.g. Sodium iodate, Mercuric oxides, Organic peroxides.

TOXIC MATERIALS: Causes death by ingestion, skin contact or inhalation, at certain specific concentration. E.g. Methanol- toxic, Formalin- toxic by ingestion and inhalation, Chromic acid, Osmium tetroxide and Uranyl nitrate- highly toxic.

COMPRESSED GAS: Gas at room temperature (20°C) and pressure, packaged as a pressurized gas by compression or refrigeration and is usually quite heavy. The potential hazard of compressed gases

occurs when sudden rupturing of the container causes it to become a dangerous projectile. E.g. Propane & Acetylene bottles.

CORROSIVE MATERIALS: Causes destruction of living tissue or irreversible alteration and destroy materials e.g. Bleach, Battery Acid, Ammonia & Hydrochloric Acid.

IRRITANTS: Reversible inflammatory effects at the site of contact. Eyes, skin and respiratory passages are affected. Formalin is a skin and respiratory irritant.

SENSITIZER: Causes allergic reaction. Sensitization lasts for life & gets worse with subsequent exposure. Formalin is a prime example ⁽⁵⁾.

CARCINOGENS: Chloroform, chromic acid, Dioxane, Formaldehyde, Nickel chloride, potassium dichromate, certain dyes etc.

CHEMICALS CAUSING TARGET ORGAN EFFECTS: Cause specific harm

to selected anatomical or physiological systems. Xylene and toluene are neurotoxins. Benzene affects blood. Chloroform, Methanol, Xylene, Toluene are reproductive toxins⁽⁵⁾.

MANAGEMENT OF CHEMICAL HAZARDS

Use cart to transport heavy or multiple number of containers from one area to another. A bottle should never be held by its neck, but instead firmly around its body, with one or both hands, depending on the size of the bottle to avoid spills. Acids must be diluted by slowly adding them to water while mixing; water should never be added to concentrated acid to avoid splattering. Acids, caustic materials and strong oxidizing agents should be mixed in the sink. This provides water for cooling as well as for confinement of the reagent in the event the flask or bottle breaks. Label the container before adding

the reagent, and dispose off when proper expiry date is reached⁽⁶⁾.

No eating, drinking or smoking in the lab. Application of cosmetics is prohibited. Wash hands frequently but hydrate with a good lotion. Keep finger nails short. At the end of the day clean all working benches with a disinfectant. Wear closed-toed shoes. Tie back long hair. Do not wear sandals, jewelry, loose or baggy clothing^(4,7).

FIRST AID

Injuries caused by broken glass: Wash the wound immediately to remove any glass pieces. Apply mercurchrome or acriflavine ointment to the wound. Cover with gauze and adhesive tape⁽⁸⁾.

Acid/Alkali splashes on the skin: Wash thoroughly; bath the affected skin with cotton wool soaked in 5% aqueous sodium carbonate if acid and 5% acetic acid or undiluted vinegar, if alkali⁽⁸⁾.

Acid/Alkali splashes in the eye: Water spray from a wash bottle or rubber bulb into the medial corner of the eye . Put 4 drops of 2% Aqueous Sodium bicarbonate into the eye, if acid, and saturated solution of boric acid, if alkali.

Swallowing acid: Make the patient drink some 5% soap solution immediately. Make him gargle with the soap solution. Give him 3 or 4 glasses of ordinary water. If the lips and tongue are burned by the acid, rinse thoroughly with water. Bathe with 2% aqueous sodium bicarbonate ⁽⁸⁾.

Swallowing alkalis: Make the patient drink 5% solution of acetic acid or lemon juice or dilute vinegar. Make him gargle with the same acid solution. Give him 3 or 4 glasses of ordinary water. If the lips and tongue are burned by the alkali, rinse thoroughly with water; bathe with 5% acetic acid.

Poisoning

Send for a physician or qualified nurse, specifying the toxic substance involved. Place the victim in the open air while waiting for the physician.

Burns caused by heat: They fall into two categories

Severe burns: If the victim is on fire, roll him in a blanket or overall to smoothen the flames. Inform the physician. Lay the victim on the ground. Do not remove his clothing. Cover him if he is cold. Do not apply any treatment to the burns. This must be left to the physician.

Minor burns: Plunge the affected part into cold water or ice-water to soothe the pain. Apply Mercurochrome or Acriflavine ointment to the burn. Apply dry gauze dressing loosely. If the burn becomes infected or does not heal, refer the patient to a physician. Never tear off the blisters that form over the burns.

ELECTRICAL HAZARD AND ITS MANAGEMENT

Electrical equipment should not be handled with wet hands, nor should electrical equipment be used after liquid has been spilled on it. The equipment must be turned off immediately and dried thoroughly. In case of a wet or malfunctioning electrical instrument the plug should be pulled and a note of cautioning should be left on the instrument. Use of extension cords is prohibited⁽¹⁾.

Bodily damage by electric shock: The symptoms are fainting and asphyxia. Before doing anything else, put off the main switch. Send for a physician. Begin giving mouth to mouth respiration immediately.

FIRE HAZARD AND ITS MANAGEMENT

Fire in the laboratory may occur due to spirit lamps, electrical appliances or other inflammable reagents used in a laboratory. All laboratories should have a fire extinguisher^(1, 2, 4), and easy access to safety showers and fire blankets. For putting off the flames from the inflammable liquids, smother the fire by throwing sand over it.

BIOHAZARDS

Can be infectious agents themselves or items (solutions, specimens or objects) contaminated with anything that can cause disease in humans regardless of its source. To operate a clinical laboratory safely, it is essential to prevent the exposure of laboratory workers to infectious agents such as the hepatitis B virus (HBV) and the human immunodeficiency virus (HIV).

Universal Precautions^(1, 2) specify how U.S. clinical laboratories handle infectious agents. In general, they mandate that clinical laboratories treat all human blood

and other potentially infectious materials as if they were known to contain infectious pathogens. The specifications apply to all specimens of blood, serum, plasma, blood products, vaginal secretions, semen, cerebrospinal fluid, synovial fluid and concentrated HBV or HIV viruses. In addition, any specimen that contains visible traces of blood should be handled using these Universal Precautions. Universal Precautions also specifies that barrier protection must be used by laboratory workers to prevent skin and mucous membrane contamination from specimens. These barriers, also known as personal protective equipment (PPE)^(1,2,6,7,9), include gloves, gowns, laboratory coats, face shields or mask and eye protection, mouth pieces, resuscitation bags, pocket masks, or other ventilator devices.

PRECAUTIONS FOR BIOLOGICAL HAZARDS

- Never perform mouth pipetting and never blow out pipettes that contain potentially infectious material.
- Barrier protections such as gloves, masks, and protective eye wear and gowns are to be worn.
- Wash hands whenever gloves are changed .Facial barrier protection should be used if there is a significant potential for the spattering of blood or body fluids.
- Dispose off needles in rigid containers; use the "one-handed" technique.
- Dispose of all sharps appropriately.
- Encourage frequent hand washing in the laboratory; employees must wash their hands whenever they leave the laboratory.
- Make a habit of keeping hands away from your mouth, nose, eyes, and any

other mucous membranes. This reduces the possibility of self-inoculation.

- Decontaminate all surfaces and reusable devices after use with appropriate hospital disinfectants.
- Use proper biohazard disposal techniques (e.g., Red Bag) .
- Never leave a discarded tube or infected material unattended or unlabeled.
- Periodically clean out freezer and dry-ice chests to remove broken ampules and tubes of biological specimens.
- OSHA requires that Hepatitis B vaccine be offered to all employees at risk of potential exposure as a regular or occasional part of their duties.

SPECIAL NOTE FOR HISTOLOGY

LABS

Oral & Maxillofacial Pathology Journal [OMPJ]

Fresh specimens of human origin must always be considered potentially infectious. Grossing an unfixed specimen is the most risk activity that can be undertaken in a histology lab ⁽⁵⁾. Fixed specimens have a much reduced risk; nearly all infectious agents are readily deactivated by fixation provided the specimen is thoroughly fixed for proper time. Tissue in the first several stations of a tissue processor may remain bio hazardous. Complete penetration by alcohol will kill all infectious agents except prions. So properly processed specimens can be handled without special precautions ⁽⁵⁾. Cryotomy carries special risk because tissue is always fresh & small dust-like particles generated from sectioning may become air borne ⁽⁵⁾.

CONTAMINATION BY INFECTED MATERIAL

In case of wounds caused by broken glassware containing stools, pus, etc.,

wash the wound immediately with

antiseptic lotion. Check whether the cut is bleeding. If not, squeeze hard to make it bleed for several minutes. Refer the patient to a physician if the material involved is known to be very infective, e.g. pus. If infected material is accidentally sucked into the mouth spit it out immediately. Use a disinfectant (e.g. Diluted Dettol) for mouth washing⁽⁸⁾. If the infected material has been swallowed accidentally, forced vomiting is to be done. Ascertain the kind of infection and take advice from a medical person.

CONCLUSION

The responsibilities of management are to anticipate problems and to develop safety procedures and training programs⁽¹⁰⁾ based on present or potential hazards that may endanger personnel and on the behavioural factors leading to unsafe acts. Safety awareness should become habit and a way of life in the laboratory⁽¹⁾.

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