Chapter

Occupational Health and Radiation Safety of Radiography Workers

Hasna Albander

Abstract

Medical imaging is the identification or study procedure for obtaining medical images of body parts. Millions of imaging procedures take place worldwide each week. Radiation protection is intended to prevent the ionizing radiation exposure from having harmful effects. Exposure may result from a source of radiation outside the human body, or from ingestion of radioactive pollution from internal irradiation. This chapter presents Occupational Health and Radiation Safety of Radiography workers in the medical imaging field. This chapter also summarizes how current employment health status and knowledge gaps can be illustrated in some key and critical occupational issues as well as diseases such as radiation, nosocomial and occupational infections.

Keywords: occupational, health, radiation safety, radiography, workers

1. Introduction

Occupation Safety and Health (OSH) is a multidisciplinary sector dedicated to worker safety and welfare [1, 2]. The goal of this organization is to promote a safe, healthy work environment through a workplace health and safety program. Common law enforces employers to take proper care of employee safety [3, 4]. The legal system can also impose other general functions, set specific tasks, and setup government regulatory bodies. [5] OSH can also protect coworkers, families, workers, employers, and many others who affected by the working environment. As hospitals focus on disease transmission, they are also places for the sick. Everyone with a health problem is more vulnerable to infection, so controlling infection is crucial in patient care [6, 7]. As a medical team member, the infection control policy considers as one of radiography worker's professional duties. This promotes patient safety, radiographers and other health team members. The emergence of new diseases, their return, and the development of hospital-acquired multi-drug - resistant infections make it even more important to implement such policies and to play a role in preventing spread of infection [8]. Microorganisms are living organisms that are too small to see. Including bacteria, viruses, protozoa, fungi, and prions. Most microorganisms are not infectious or disease-free and essential to our well-being. Normal microbial flora is known through non-infection or disease-free microorganisms within or within the body. They protect and digest the skin, protect it against dangerous organisms that can cause infection or disease. Pathogens are called infection-causing microorganisms. Sometimes the factors that help spread the condition are called the cycle of infection. It is necessary to provide the infectious organ, infectious tank, exit portal, host, front door and move from tank to infectious person [9, 10].

2. Occupational health safety of radiography workers in the hospital

2.1 Infection exposure in in the hospital

It's not the infectious organism that transfers it from storage to recipients that interferes most directly with the infection cycle. To do so, the six main transmission routes should be understood. Direct contact is the first itinerary. This means that an infected person must contact the host and directly contact organisms with the sensitive tissue. For example, if an infectious organism contains the mucous membrane of an individual, syphilis, HIV infections may occur directly in the mucous membrane of a susceptible host [11, 12]. Furthermore, the frequent contact with staphylococcal and streptococcal patients is often associated with skin infections of hospital workers. The five other major paths of transmission are indirect and include transport of fluids, vectors, vehicles, airborne media, and droplets. An object of a pathogenic organism is known as a fomite. The catheter contaminated with urine is a typical example. Also included may be the x-ray table, Bucky vertical, image receptors, sponsor positioning with infectious fluids or, perhaps, gloves. Vectors are an arthropod whose organism develops or multiplies an infectious organism before it becomes a new host. Such infected patients can spread diseases to individuals. Examples of vectors include malaria- or dengue-carrying mosquitoes, bubonic fleas, and spotted fever spreading Lyrne or Rocky Mountain disease [13, 14]. Every vehicle with microorganisms is a medium. For example, contaminated food, water, medicines, or blood. The airborne air is contaminated either by five microns of dust or droplet nuclei (a micrometer, μm 0.001 mm) evaporated by an air-microorganism with long suspended air or by a smaller spore. Air currents and a sensitive host inhale these particles. Special air handling and ventilation is needed to avoid airborne transmission of these infected particles. M. Airborne infections include tuberculosis, rubeola, and varicella. Varicella may also contract these viruses by contacting vesicles. Goutlet contamination is usually experienced by host cough, sneezing, talking, or singing [15, 16]. Droplet transmission involves contact with susceptible person's large eye droplets, nose, and oral microorganisms with mucosal membranes. Unusually long, not air-suspended, 3 feet or less. Examples include influenza, meningitis, diphtheria, pertussis, pulmonary gout spread. Although many organisms may need constant warmth, humidity and concentration of nutrients, bacterial heating, cold and dry endosphorus. Endospores can float in poisonous corners awaiting an invading host. Bacterial spore-forming organisms cause serious but rare diseases like tetanus, anthrax, and botulism. Spores inhaled, eaten or contacted [17, 18]. The host provides moisture, warmth, and nutrients in an endocrine cell. Epidemiological studies show that for weeks, some viruses can resist drying at once. One case is that spores or viral infections cannot overestimate herpes virus cleanliness (orally and genitally).

Radiation exposure measures ionizing air by ionizing photon radiation, i.e. gamma and x-rays. it is defined as the power emitted by radiation within the given volume of air, divided by air mass [19].

2.2 The body's defense against infection

The three ways the human body is protected from invasion by microorganisms is to apply natural resilience and defense, resistance (also known as active immunity), and a temporary passive immune system. Mechanical barriers such as intact skin and mucous membranes are natural. Natural power. Natural power. Injuries such as severe burns, abrasion, and cuts can interfere with this skin protective barrier and increase infection risk. Respiratory, urinary, gastrointestinal and reproductive membranes trap foreign particles. The respiratory tract is also bordered by cilia carrying body mucus. Urinary tract is protected against increased urinary composition and external flow infections. Chemicals like lysozyme are also used to destroy invasive microorganisms in human tear, stomach, vagina, and skin acids [20].

Skin pH, salt, and dryness decrease the number of skin bacteria and prevent unwanted flora overgrowth. Nonetheless, microorganisms have access to the body. This results from daily activities like shaving and brushing [21].

This invasion begins with our second line, the inflammatory reaction. The flux of fluids and white blood cells through tissues increases blood flow to the site and allows swallowing and destroying invasive pathogens. That's called phagocytosis. When viruses infect the body, virus-infected cells create interferons, small protein molecules that protect non-infected cells and others from intrusion. Interferons are species-specific, currently in herpes and chronic hepatitis B and C treatment laboratories.

2.2.1 Acquired immunity

People are born with some immunity, but most people become disease resistant by becoming infected with a particular organism. This infection may or may not be an obvious disease. Immunity may also be granted from dead or weakened micro-organic strains infections or from inactivated toxin. This is known as immunity to some infection. Immunity is acquired because the body differs from the body 's foreign proteins. These substances are called antigens. Specific antigen-formed protein substances are antibodies. Antibodies. Antibodies B-cells, a white blood cell, are created to kill invasive alien substances with other white blood cells and avoid re-infection with that antigen. Because the body forms its own antibodies, it has long-term immunity.

2.2.2 Passive immunity

Passive immunity follows a specific infection with preformed antibodies. In this case, individuals receive pooled immune globulin (human blood and general population antibodies) before and after exposure to hepatitis A. Antibodies act promptly, but weaken over time to prevent disease. Neonate is temporarily immune to infections due to mother-to-fetus antibodies passing through the uterus. After birth, the infant continues to receive passive immunity. Since the body does not produce these antibodies, passive immunity is short-term [22].

2.3 Infectious diseases affected of the healthcare

Ergonomics investigates the working environment of the human body. In recent years, ergonomic awareness and training have reduced workplace injustice, but concern remains. The U.S. Labor Statistics Bureau reports hospital workers suffering similar injuries from industrial workers. The most commonly reported injuries are musculoskeletal disorders (MSDs). OSHA classified MSDs are sub-categories of recurrence motion injury (RMIs), repeated strain wound (RSIs), and cumulative trauma (CTDs). RMIs and RSIs, as their names suggest, result from repetitive or extensive pressure application. Stress from repetitive movement, excessive expansion, or long-term maintenance of the same position leads to muscle tissue-developing microtrauma. This microtrauma is the basis of cumulative trauma disorder, leading to chronic malaise and increased musculoskeletal lesions. CTD symptoms are pain, numbness, tingling, shyness, swelling, weakening, loss of function or overdeveloped muscle group (especially in hand and wrist). All health workers are at risk from lifting and moving patients and devices due to back strain. In addition, top neck and shoulders and rotating rashes often tighten the x-ray tube. Computerized technologists are more likely to experience spinal stress and RSI from intensive keyboard work. Intense keyboard work. RSI keyboard affects CTD 's hands and grips. Like tendinitis, carpal and ganglion syndrome. Imaging technologies, whose work takes longer to view the cathode ray tube monitor, also have vision problems. While ergonomic awareness is important for all employees, it's especially important for sonographers. RMIs and RSIs often affect Radiographer shoulder, arm, or wrist 80% of sonographers suffer work injuries. Sonographers number 80 percent. The root causes of these problems include equipment design, low posture, constant transducer pressure, difficult movements, unsatisfactory breaks, and overall stress. In recent years, high-end sonographic injuries have increased due to changes in equipment design and work characteristics [23].

Older transducers were heavier, but the patient had a stable arm that supported the transducer 's weight. New transductors are smaller and lighter, but their pressure and motor skills are needed. Furthermore, digital systems eliminated the need to change cassettes and process films to reduce activity. Imaging takes longer and specialization increases resemblance and recurrence. There are more tests; with techniques evolving, many tests are longer, harder and more repetitive. OSHA works with hospitals and equipment manufacturers to improve sonographic ergonomics, and education programs emphasize sonographers' role in postures, change positions, and breaks. Work injuries are minimized when enough equipment is available and properly used, and workers support each other. Frequent breaks and changes in position help minimize stress and position. Studies show that the right approach is continuing training programs and employer responses to employee ergonomic interests [6, 24].

2.4 Nosocomial infections

About 2 million patients are infected with nosocomial every year. Although many of these infections pose life-threats, CDC estimates that 90,000 people die from hospital-acquired infections every year and most of them are preventable. Medical conditions are ideal for developing and transmitting nosocomial infections. Typical sources of nosocomial infection include contaminated hands, instruments, and urinary catheters that facilitate microbes entering the body. Invasive methods allow pathogens to enter bloodstream and overcome patients' defensive mechanisms. The extensive and inappropriate use of wide-spectrum antibiotics has resulted in either hospital or community drug-resistant infections. Some of these infections can not be treated because they resist existing medicines. Developing a new medicinal product takes time, is expensive, and does not seem a lasting solution to this complex issue. Several nosocomial infections involve medical and multidrug-resistant patients. This means more than one antibiotic resistant. *Staphylococcus aureus* (MRSA) methicillin and enterococci resistant to vancomycin cause injury surgery, urinary tract and blood fluid infections. MRSA may also cause respiratory infections. Penicillin-resistant aeruginosa causes streptococcal and pseudomonas respiratory infection. The development and spread of these multi-drug-resistant infections was associated with antimicrobial overuse and poor infection management practices. Intensive infection control is required to reduce spread. These pathogens are hard to treat. Over the last 20 years, MRSA was recognized as a health problem. MRSA has been a community issue in recent years and is known as a community-related issue, or CA-MRSA. The CDC has created a relationship between new antibiotic use and sharing of personal contaminated objects, people in crowded environments, and poor hygiene. MRSA is associated with skin and soft tissue infections that can be treated with alternative antibiotics. These groups affected drug users, men who have sex with men, prisoners, military personnel, children in nursing facilities and athletes. Even when we write, other organisms adapt [2, 3, 17].

2.5 Management of occupational exposures to blood borne pathogens

If there is a sudden needle stick or a contaminated object breaks the skin, let the wound bleed under cold soap water. When the patient's body fluids sprinkle x-ray eyes, nose, or mouth, rinse your mucosal membranes with water. Even if the injury might seem trifling. In addition to the incident report, most hospitals now look for a baseline blood sample to prevent occupational infections. In addition, the health care provider will need to advise the X-ray technician on post-exposure prophylaxis (PEP) therapy after contaminated needle puncture. If treatment is recommended, it should take 2 hours for blood to become exposed. A four-week dos-drug regime is currently recommended for most PEP-defined HIV and several drug options. Hepatitis B and C are also tested using the x-ray HIV test. If radiologists have not used a vaccine for hepatitis B, the immune globulin and hepatitis B vaccines initiate immunity immediately. There is currently no effective hepatitis C therapy, therefore a follow-up HCV test is required to determine if the radiograph is exposed to a positive source. Because the blood cannot see HIV infection for about three months, it takes six months to get another HIV test [11, 17, 20].

2.6 Handling and disposal of contaminated

2.6.1 Handling linens

Objects or linens soiled with body secretions or excretions can be considered contaminated, but not visible, and can be used as fomites. The linen of every patient should be treated as lowly as possible. Place the edges of the linen in the center without throwing or flapping, and place balled linen immediately in the barrier to prevent contamination from the air. Most institutions today treat linen equally irrespective of the contamination. Place the linen in plastic bags, and use washing agents to prevent infection. Many hospitals offer hot water bags for cleaning, and laundry personnel process the linen several times [7, 9].

A modern hospital uses numerous devices to deliver contaminated waste, from simple objects such as cups and fabrics to complex objects such as catheterization. Contaminated disposal of waste only disposable items is used once, and then discarded. The only exception is that the same patient reuses the same non-sterile product immediately (e.g., the emesis basin). Each hospital has protocol for the disposal of devices. Some are split into containers covered with glass, plastic or paper, and others are combined. Follow procedure with x-rays. For disposal of objects contaminated with blood or liquid body, the Regulations require a biohazard symbol in the relevant container and marking. The needles and syringes used are placed in special, non-syringe recovery containers. New requirements for safer OSHA medical devices could reduce the high number of needle sticks that more unprotected, sharp workers had previously produced. There are lots of safe medical equipment. Some have a sheath to protect the contaminated needle, others have a needle which is retracting. When the needle is removed from the vein, the medical practitioner may take the needle back into the syringe. Use those safety features to avoid accidental needle sticks. When initial venous access is established, the needle-free system offers maximum needle stick protection and should be used in drugs and contrast media. Contaminated bandages and dressings are treated with gloves, they are directly sealed and disposed of in red plastic biohazard bags. Before being sent to the laboratory, place the specimens in safe containers and in a plastic bag marked with a biohazard symbol [21, 22].

2.6.2 Isolation technique

Before UP, diagnosis or suspected transmissible disease was the reason patients were isolated. All patients indicated that UP and BSP were potentially infectious. These new precautions were used in hospitals, in conjunction with their isolation policies. Hence, this text identifies several types of isolation systems previously used and describes the CDC recommendations as they stand. Initially, the hospital guidelines recommended one of two hospital systems: a category-specific system with seven different types of isolation, or a system specific to the disease. These two systems replace the current Guidelines. In addition to a synopsis of precautionary types and patients requiring precautions, Annex G is a CDC document reproducing reconciliations in order to prevent hospital isolations [3, 9, 12].

2.6.3 Transmission-based precautions

The CDC has recommended that patients be isolated by transmission precautions as part of the standard precautions. This system replaces precautions for older categorized diseases that are based on transmission. These sets aim to minimize airborne transmission, droplets and risk of contact. They can be used individually or with standard precautions, on a number of disease pathways [4, 9].

2.6.4 Airborne precautions

Airborne precautions aim to reduce the risk of transferring infectious or gout nuclei particles (5 ppm or less) to a susceptible person. They take airborne precautions to prevent tuberculosis and rubeola. Medical professionals and visitors in a room of an infectious person must wear NIOSH-approved particulate breathers. These masks must filter 1 micron with an efficiency of 95 percent. Patients undergo airborne treatment in rooms with negative airflows and special air circulation, with more than six external air interchanges per hour or via HEPA filters. These rooms are forever closed [3, 7].

2.6.5 Droplet precautions

Droplet precautions have been designed to reduce sensitive nose or mouth contact with particles of large droplet connectivity (over 5 microns). Precautions are applied to prevent transmission of diseases such as diphtheria, pneumonia, and influenza. Medical staff and visitors in contact with these patients must wear surgical masks but they do not require special circulation of air in these rooms. Contact precautions are designed to minimize the risk of pathogen transmission through direct skin-to-skin contact, or indirect contact with a contaminated object. Contact precautions are used to prevent MRSA- and new VRE-resistant infections. (H7:0157) Coli. It must be worn by doctors in close contact with infected patients who cause gastrointestinal and renal problems and various sunlike infections such as glove, and clothing. Contact precautions when merging airborne. Airborne and contact precautions are combined to minimize the risk of airborne droplet nodes transmitting pathogens and direct contact with the skin. These precautions are used to prevent the spread of the chicken pox and herpes zoster by SARS and varicella viruses. Health care workers without a pox should avoid contact with patients who are infected. Infected personnel do not need to have any masks beforehand [7, 9, 23].

2.7 Radiography of isolation patients

Using friendly patient interest in protective radiation functions and avoiding fear or repulsion, radiographers can help alleviate those sensations. Isolation Two patients require x-rays, two rays preferred. Patient belongs to the 'dirty' team, and the device is managed by the 'clean' Member. Although both radiographers must take all the prescribed isolation precautions, the 'clean' member does not have direct contact with the patient, bed or any item that the patient may have touched. Only the X-ray machine and uncovered image receptors (IR) use this radiogram. This team method minimizes contamination with the x-rays, which is difficult to disinfect completely. Radiographer and his colleagues shall prepare the required IRs before entering the insulation room by putting each in a smoothly fitting plastic bag and the lead table of Don Radiographer. The jewelry should be removed from the x-ray, view it in the pocket or pin it in the uniform of the x-ray [9, 12, 25].

At the door, radiographer shall take the necessary precautions (e.g., gloves, dresses, and masks). Apply the recommended guidelines for isolation and donate protective clothing for the specified type of isolation. It can be carried out in a hallway adjacent to the area in which the room is isolated. Now the radiographers are ready to go to bed. Welcome to the procedure, explain, and introduce yourself. The dirty team member places the IR properly, so that the exposure side is toward the radiation tube. Team cleaner locates the machine and displays controls. After each exposure has finished, the IR is recovered with partial deletion of the protective cover. It then offers an edge-clean teammate. The contaminated cover is placed in the appropriate container which keeps the IR in the cabinet of the engine. The radiology technologist must make sure the patient is safe and comfortable, before removing the x-ray dress at the end of the test. Radiology technologist must firstly remove the gloves [13, 15, 26].

2.8 Precautions for compromised patients

The immunity of the patient is very limited, and it takes special precautions to prevent inflammation. Organ transplants may be received, along with immunosuppressive medicines. The burning of patients and neonates may also require these precautions. Patients undergoing chemotherapy sometimes use these precautions to reduce resistance. Once this is called reverse isolation, or isolation from protection. The 1983 Federal Isolation Directive removed the protection class, mainly because it differs in purpose and procedure from other categories I of isolation. The basics are identical! Those terms may still be used in the clinical environment by the radiograph. Precautions for an affected patient require that the equipment be cleaned before they enter the room. Hand hygiene is required before the patient touches the bed or the patient's items. Masks, caps, sterile robes and handkerchiefs can be worn as an operation or modified. Modified technique leads to very high sterile-protocol aseptic medical therapy. Specific precautions are taken outside of the room for patients. Team member is the "clean" X-ray that puts the patient under guard. This X-ray user avoids contact with uncovered IRs, X-rays and other potentially contaminated objects using the right protective clothing. This X-ray folds the edges, keeping it open if the second X-ray is to properly cover the IR inside the sterile cassettlement. It's important that there is no contamination outside the cover. The patient, bed, clean object and IR only affect the clean x-ray and only the filtered x-ray affects the device. That is precisely the opposite of isolation.

3. Conclusion

In this chapter, we defined aseptic medical systems as a means of reducing and interfering with the process of spreading pathogenic microorganisms across the environment. Operational asepsis however constitutes destruction of equipment or spores and organisms for patient care. In the first case, sterile linen, gloves, and surgical devices are examples, but many other operations require sterile treatment, such as lumbar perforations, catheterization, and injections, as well as some patients who are immunocompromised. Too few naked microorganisms are visible, like bacteria, protozoa, prions, and fungi [2, 3]. Some microorganisms protect and benefit individuals and are called normal flora: some are hazardous, cause disease and infection, and are known to be pathogenic. The infectious organism, infection tank, exit and entry portals, transmission mode and sensitive home are all part of the infectious cycle. Include body protection in three ways: resistance, defense, immunity, short-term immunity, and microorganism infestations. Body protection includes factors propagating disease. New diseases, existing effects or geographical conditions, and repeated old diseases caused by old diseases or mutated diseases are the emerging conditions. Emerging diseases are a major issue. Many factors can lead to emerging diseases, including increased exposure to vectors, population growth, migration to crowded cities, global travel, antimicrobial overuse, public safety crashes, and biological terror [7, 8]. The total number of cases in the U.S. and worldwide continues to increase. HIV/AIDS is a major public health issue. MSM and IDUs are the most common cases. Transmission routes include sex, infected blood, body and needle fluids, placenta, fetal mother, and breast-milk babies. As a blood borne pathogen, transmission risk to health workers is very low. The main concerns are health workers, both bloodborne and diagnosed with hepatitis B and C. 0 Vaccines and preventive therapies, but C is not available. Medical workers are less likely to contract C, but you get more chronic liver infection and cirrhosis. Contamination of feces and water transmits A and E. Hepatitis A is the disease's most common vaccine. If needles are infected with the patient's eye needle, nose, or mouth splashes with the patient's fluid, post-exposure healthcare practitioners should use procedures. Tuberculosis is primarily M-induced pulmonary disease. Air pollution and tuberculosis. Foreign-born residents are America is most common. Tuberculin skin testing is the easiest way to test TB infection. Real TB hospitals must undergo procedures such as tuberculin skin testing, personal breathing facilities, one or more negative air pressure and special ventilation isolation rooms. Aseptic therapy aims to reduce transmission risk to sensitive people of infectious organisms. Frequent hand hygiene is the best aseptic practice [1, 2, 23]. Hand hygiene includes soap and water washing your hands, taking spumes or gels if no visible soil is present. Good household management reduces airborne infections and pathogens. Examples of possible forms of medical aseptic include dust, disinfection, and good liner management, dry and wet waste disposal, and sharp container use. Current isolation and infection management policies have evolved in home quarantining families. Initially, infection was only diagnosed in isolated patients, but HIV and AIDS changed. Besides infectious diseases, new treatment processes were introduced for all patients in hospitals. The current system has two areas: (1) Defense and hygiene barriers are standard precautions for all patients based on patient contact. (2) Transmission-based precautions apply to patients with infectious diseases [13, 26].

Health workers must wear protective clothing, regardless of patient contact. Airborne, droplet and contact transmission risk can be reduced independently or in combination by using three categories of precautions. The isolating patient's x-rays involve two individuals: (1) the x-rays are placed as "clean x-rays" (2) the receptive image is "dirty" and the patient as infectious. If they remember their roles, cross-contamination is minimized. Both X-rays give the inspection and testing room clothing. X-rays are carefully removed, imaging, recording equipment disinfected, and hand hygiene after testing is done. Radiology Department may refer isolated patients for imaging studies [23, 24]. To wear protective clothing and work as a team to complete the exam, at least two radiation are needed. The first is patient placement, and the second is equipment placement and control. After transportation, the stretcher or wheelchair is covered in paper. The linen, wet and dry waste should be properly disinfected in the X-ray room. Immunosuppression requires safeguards for endangered patients, including weakened immune systems, drugs, brandy, and neonates [17, 19]. The patient is in control as "clean ray" and "dirty." Easy hands smooth clothing, gloves and sterile clothing are safeguards. All organisms, spores, and procedures, including aseptic surgical disease, must be destroyed. Operational aseptics are often surgery-related but also used when an invasive procedure such as lobster punctures or urinary catheterization is performed. Aseptic surgical therapy also treats patients with immune problems. Operations involve sterile fields, operational sprinkling, and invasive clothing. Four different sterilization techniques and equipment can be used for chemical, dry, ethylene-oxide gas, plasma gas and autoclave. Each method recommends advantages, disadvantages, and uses. Sterility and biological indicators are reused to ensure that all packages are properly sterilized, damaging all forms of microbial life during sterilization. Micro-organisms can use sterile fields without sterile equipment. Sterility and supply of the packet must be adequately confirmed and opened before establishing a sterile field to prevent contamination. If a sterile field is established, additional sterile objects and liquids may follow suitable procedures [12, 24].

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Author details

Hasna Albander
Medical Physicist Department, Prince Sultan Military Medical City Riyadh, Riyadh, Saudi Arabia

*Address all correspondence to: hasna_bb@hotmail.com

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