MEDICAL WASTE INCINERATION AND THE RISK OF CANCER: A REVIEW

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INTRODUCTION

Medical waste refers to clinical waste materials that are produced from healthcare facilities such as hospitals, doctor's offices, pharmaceutical manufacturing plant, nursing homes and research laboratories (De Marini et al., 1992). These materials may include used syringes, soiled dressings chemicals used to treat illnesses, equipment and facility chemical cleaners, radioactive materials etc. Disposal of this waste is an environmental concern (Elliot et al., 1996). In high income countries, such as USA each person generates about 13 pounds (6kg) of medical waste per year while lower income countries such as Cambodia generates between 1 pound (0.5kg) of medical waste per person each year (Elliot et al., 1996).

CLASSIFICATION OF MEDICAL WASTE

Non Hazardous waste

WHO suggests that non-hazardous waste makes up of 75 - 90% of medical waste. These waste items include papers, soda cans, cartons and other office related disposable items. (WHO, 2009).
Hazardous waste
10 - 23% of medical facility waste may be infectious or biohazardous, potentially exposing healthcare workers; patients and community members to injury, infectious diseases and toxins (WHO, 2009).

MEDICAL WASTE INCINERATION
• The term incinerate, means to burn something until nothing is left but ashes. An incinerator is constructed: of heavily, well insulated materials, so that it does not give off extreme amount of external heat (Dennison, 2009) needles, body parts and fluids, diapers, laboratory cultures etc is infectious and potentially dangerous, many Hospitals feel it is safe to incinerate these, rendering it harmless (Elliot et al., 1996). Oilman and Knox (2005) states that when burned hospital and medical waste emit various air pollutants including Dioxin, radioactive substances, mercury etc.

MERCURY AND THE RISK OF CANCER
Mercury is a genotoxic substance. Genotoxins are substances that are mutagenic (alter genetic information), teratogenic (interfere with fetus development), or carcinogenic (causes cancer). (Driver et al., 2000). Mercury is used in thermometers, dentals and amalgam fillings, florescent lamps and sphygmomanometers. Mercury is a bye product of medical waste incinerations (Driver et al., 2000).

Mercury enters the air from burning of coal and medical waste. Deposits of methyl 1 mercury may be formed in water and soil by small organisms (bacteria). Methyl mercury builds up mime tissues offish, larger and other fish tend to have the highest: level of mercury. One is exposed by eating fish or shellfish contaminated with methyl mercury, breathing vapors in air from incinerators and from the release of mercury from dental work and medical treatments (Ahlborg and Victoria, 1997).

SIDE EFFECTS
Exposure to high levels of metallic, inorganic or organic mercury can permanently damage the brain, kidneys^ lungs etc; This is because mercury has the ability to bury itself deep into the tissues and organs escaping the host immunity and is capable of causing cancer in these organs. (Driver et al., 2000$. Selenium is an antioxidant which binds in place of oxygen of which protects against free radical damage from chemicals which can lead to cancer. Mercury can bind to selenium making it useless for this protective purpose. Effect on brain functioning may result in irritability, shyness, hearing malfunctioning etc.
A research carried out showed that mercury chloride has caused several types of tumours in rats and mice and methyl mercury has caused kidney tumours in male mice. The US environmental protection also declared that methyl mercury and mercury chloride are possible human carcinogens (Ablborg and Victorin, 1997).

**SIGNS AND SYMPTOMS OF MERCURY INTOXICATION**

Acute exposure caused by inhaled elemental mercury can lead to pulmonary symptoms. Initial signs and symptoms such as fever, chills, shortness of breath, metallic taste and pleuritic chest pain (WHO, 2009).

**DIOXIN AND THE RISK OF CANCER**

Dioxin is the short name for 2, 3, 7, 8 - tetrachlorodibenzo para-dioxin (TCDD). Dioxin is inextricably linked to environmental pollution from medical waste incineration. Medical waste incineration is a source of dioxin pollution, due in part to the larger amount of disposable polyvinyl chloride (PVC) products used by hospitals. Dioxin can cause cancer by breathing low levels in air, drinking low levels in water, skin contact with certain pesticides and herbicides. Combination of heat and chlorine produces dioxin (Villeneuve and Steenland, 2010).

In both animal and epidemiologic studies, exposure to dioxin has been associated with increased risk of cancer. A work carried out on workers who work in plant where dioxins are produced concludes that there is an increase in risk of breast and respiratory tract cancer among the workers (Colin et al., 2009).

Some other authors examined 1,615 workers exposed to dioxins to determine if there were increased morbidity rates from exposure. Historical dioxins levels were estimated by a serum survey of workers. Vital status was followed from 1942 to 2003, and cause specific death rates and trends with exposure were evaluated. They found out that dioxin can cause soft tissue sarcoma and has also been seen to increase the incidence of breast cancer (Villeneuve and Steenland, 2010).

**MECHANISM OF ACTION**

It has been established that dioxin binds to the aryl hydrocarbon receptor (AHR) in human tissues. The ARH-TCDD complex enters the cell nucleus to interact with specific DNA sequence. The complex is believed to act as a transcription factor of the alpha-beta family that initiates a signaling cascade which provokes the observed tissues changes e.g. chloroacne (Colin et al., 2009).
OTHER SIDE EFFECTS
Damages the immune system, interferes with Hormonal systems, birth defects, inability to maintain pregnancy, decreased fertility, reduced sperm count, endometriosis, diabetes, learning disabilities and King cancers. Dioxin can cross the placenta into growing infants and it can be found in the fatty breast milk (Lewtas, 2008).

SIGNS AND SYMTPOMS
1. Lesions of the skin as a result of contact with the various compounds present in the toxic cloud.
2. Chloroacne, an ache like skin condition that results from the exposure to chlorinated hydrocarbons like dioxin. Chloroacne manifests itself with the formation of small bumps, termed comedoms, and cysts on the cheeks and behind the ears (Lewtas, 2008).

RADIOACTIVE WASTE AND THE RISK OF CANCER
Radioactive waste is an example of a genotoxins. Radiation describes one particle or body emitting energy, which travels through space and is absorbed by another body. Ionizing radiation displaces the electrons in atoms and may cause damage; to cells (Oilman and Knox, 2005).

Medical waste incineration does not destroy metals or reduce radioactivity of waste. Incinerators like many combustion devices such as automobile engines, convert combustible materials mainly to carbonmonoxide and water (steam). But they generally also create toxic by-products, known as "products of incomplete combustion" and these include radionuclides which may be emitted from burnt metals like lead from the radiology department etc (De Marini et al., 1992).

Thorotrast, a (incidentally-radioactive) suspension previously used as a contrast medium in x-ray diagnostics, is a potent Human carcinogen known because oil its retention within various organs and persistent emission of alpha particles (Oilman and Knox, 2005).

All radionuclides are carcinogenic, although the nature of the emitted radiation (alpha, beta, gamma, or neutrons) has different radioactive strength. Its consequent capacity to cause ionization in tissues and the magnitude of radiation exposure determines the potential hazard. For e.g. Alpha radiation has low penetration and is not a hazard outside the body but is carcinogenic when inhaled or ingested (Lofroth et al., 2006).

The type of radiation emitted from medical waste incineration is mainly alpha particles which can cause ionization which in turn will cause unwanted chemical reactions in the cell; they can also damage DNA prompting an increase in cancer risk (Eofroth et al., 2006).
ALTERNATIVES TO INCINERATION
Hospitals don't need to burn as much waste as they often do. They can take steps to reduce the need to burn waste and expose our communities to toxic air pollution. These steps include.

Waste reduction and recycling: Hospitals can reduce the need to burn medical waste by reducing the amount of waste they produce. Much of the waste burned in medical waste incinerators can be recycled and: remade into any items instead. Recycling keeps these items from being burned reducing air pollution and saving natural resources at the same, time e.g. metals, paper and glass. Such plastics such as polyethylene and polyprolene, can be efficiently recycled (Wingerther, 2006).

Auitoclaving: While Federal law requires that certain types of infectious hospital waste be incinerated (body parts and laboratory cultures for example). Not all medical waste needs to be burned. Using superheated pressurized steam, hospitals can sterilize some medical waste so it can be: harmlessly buried in landfills. (Steinhart, 1986).

Using non-toxic equipment alternatives: Alternatives to many commonly used medical items containing dioxin and mercury do exist for e.g. hospitals can use thermometers that contain no mercury and non-PVC plastics items that contain no dioxin or chlorine. (Wingerther, 2006).

Using these alternatives will reduce much of the toxic materials from incinerator emissions.

INVESTIGATION OF LUNG CANCER
1. History and physical examination!
2. Chest x-ray
3. CT scan (computerized tomography) 4; MRI (magnetic resonance imaging)
5. Sputum cytology
6. Bronchoscopy
6. Biopsy
7. Theracentesis
8. Mediastinoscopy

LABORATORY DIAGNOSIS
Lung cancer is often suspected after an abnormal spot is found in a chest x-ray done to evaluate a cough or chest pain. During this frightening time it is helpful to find out if the abnormality is
benign or malignant. A biopsy or sputum can be sent to the laboratory for investigation but the use of sputum cytology is limited to those tumours that extend into the airways. Sputum cytology is not always accurate and can miss some cancer cells. So biopsy is recommended. (Young and Heat, 2000).

After biopsy, the sample is sent to histopathology laboratory for examination. In the laboratory the tissue is processed as follows;
- Grossed, fixed in 10% formalin, dehydrated in ascending grades of alcohol
- Cleared in xylene
- Impregnated in paraffin wax
- Embedded in paraffin wax using embedding molds
- Sectioned by microtomy
- Attached onto a grease-free slide by means of water bath
- Fixed unto the slide on a hot plate
- Stained by haematoxylin and eosin

REFERENCES


