An investigation was conducted on status of Bio-Medical Waste production in Government and private hospitals in the different cities and towns of Bihar including capital city, Patna. It is observed that a large number of hospitals and other health care centers in Bihar are not following the rules and regulations of Bio-Medical Waste (Management and Handling) Act 1998 and 2011. Bio-Medical Waste includes dressing material, food waste, anatomical body parts, plastic disposable items, needles, chemicals, wastes with heavy metals and radioactive waste which can transmit various diseases and may be harmful to human health in many ways. This paper focus on amount of different kinds of untreated Bio-Medical Waste produced per month in Bihar and their impact on human health.

Bio-Medical Waste is generated during the diagnosis, treatment, or immunization of human beings in hospitals, diagnostic centers, blood banks, dental centers and research centers. According to Schedule I of Bio-Medical Waste (Management and Handlings) Rules, 1998, Bio-Medical Waste includes wastes like human anatomical waste, animal waste, microbiology waste, sharps, discarded medicines, solid waste, liquid waste, incineration ash and chemical waste. If these Bio-Medical Waste are not disposed properly they constitute an obvious hazard of infection in people handling them as well as if disposed off in common places or common municipal waste dumps, may infect rag-pickers, children playing near these dumps and people residing near these dumping areas. According to State Pollution Control Board (SPCB) of Bihar, there are only 823 medical centers are registered under Bio-Medical Waste (management and handling) Act. A large number of private hospitals in big cities of Bihar such as Patna, Bhagalpur, Muzaffarpur, Gaya has not registered in SPCB and their Bio-Medical Waste is being disposed off alongwith common waste near hospitals or in common municipal waste dumps.

**RESULTS AND DISCUSSION**

As a result of present investigation, there are 406 hospitals, diagnostic centers, dental centers and other primary health centers in ten cities of Bihar (Table-1) in which 114 are located in capital city Patna which generate a large amount of Bio-Medical Waste as categorized in Schedule-I of Bio-Medical Waste (management and handling) Rules, 1998 (Table-2). It is observed that these medical centers in Bihar are not destroying their Bio-Medical Waste by safe and proper methods and usually dispose off these wastes in common places near hospitals or in common municipal waste dumps.

**HUMAN HEALTH RISK ASSOCIATED WITH BIO-MEDICAL WASTE:**

**EFFECTS OF PHYSICAL BIO-MEDICAL WASTE:** Physical Bio-Medical Waste includes sharps like needles, broken syringes, sharps etc. can cut or pierce into the skin and get in direct contact with the body fluids thus directly capable of transmitting diseases which may be HIV/AIDS, Viral hepatitis B and C, other diseases such as malaria, tuberculosis, virus born diseases such as hemorrhagic fever, septicemia and other diseases which can be transmitted by blood or body fluids (Table-3). Thus, sharps may not only cause physical injuries like cuts and punctures but also infect by various infection if they are contaminated with pathogens.
Table-1. Number of hospitals and other centers where Bio-Medical Waste are not managed properly

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of Districts</th>
<th>Nos. of Health Centers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Panna</td>
<td>114</td>
</tr>
<tr>
<td>2</td>
<td>Gaya</td>
<td>21</td>
</tr>
<tr>
<td>3</td>
<td>Shahalpur</td>
<td>14</td>
</tr>
<tr>
<td>4</td>
<td>Darbhanga</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>Muzaffarpur</td>
<td>14</td>
</tr>
<tr>
<td>6</td>
<td>Nalanda</td>
<td>19</td>
</tr>
<tr>
<td>7</td>
<td>Nawada</td>
<td>15</td>
</tr>
<tr>
<td>8</td>
<td>Rohitas</td>
<td>35</td>
</tr>
<tr>
<td>9</td>
<td>Purnia</td>
<td>79</td>
</tr>
<tr>
<td>10</td>
<td>Vaishali</td>
<td>80</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>406</strong></td>
</tr>
</tbody>
</table>

EFFECT OF CHEMICAL WASTE: Chemical wastes of hospitals includes disinfectants, antiseptics, sterilants, genotoxic substances, and other related compounds which can produce chemical burns or accidental exposure or cause toxicity. The main path way of exposure to chemicals are inhalation of dust or aerosol, absorption through skin, ingestion of food accidentally contaminated with cytotoxic drugs, chemicals or waste and ingestion as a result of bad practice, such as mouth sucking of chemicals through the pipette. Exposure may also occur through contact with bodily fluid and secretions of patient undergoing chemotherapy. Many cytotoxic drugs are mutagenic, extremely irritant and have harmful local effects after direct contact with skin or eyes cause dizziness, nausea, headache or dermatitis. Toxic effects of different antiseptics, disinfections, sterilants and other related are described in Table - 4.

EFFECTS OF BIOLOGICAL WASTE: The biological waste in hospitals consists of human anatomical waste like human tissues, organs, body parts, fluids, blood, placenta and aborted foetuses. It also include experimental animals, laboratory cultures, specimens of micro-organism and live or attenuated vaccines used in research and waste generated by veterinary hospitals. The effects of these biological waste on the health of health care workers/providers and people of local community depend upon the dosage of infective agents, the susceptibility...
of the individual and portal of entry as well as on the methods
of disposal. If the cultures and infective materials are not
disposed properly, they constitute an obvious hazards of
infection in people handling them as well as if disposed off in
common municipal waste dumps, may infect rag-pickers and
children playing in these dumps. In addition, the municipal
dumps with all the biological waste thrown indiscriminately
become a sight for sore eye causing feeling of disgust and
unacceptable aesthetically. The danger of re-digging of
anatomical waste by stray dogs is also inherent in these
dumps if these are not buried in deep burial sites and disposed off in
a superficial or shallow buried pit.

In Bihar, a large number of hospitals and health care centers
has not registered in SPCB and their Bio-Medical Waste has
disposed off along with common waste in common places
near hospitals or in common municipal dumps. It results
diarrhoea, dermal irritation, Gastroenteritis, ill effects on CNS
and renal systems, hepatitis B and C, HIV/AIDS etc. in health
workers, rag-picker and other people. Thus, all the health
centers should disposed off their Bio-Medical Waste under
the guidelines of Bio-Medical Waste (management and

REFERENCES


<table>
<thead>
<tr>
<th>S. No.</th>
<th>Pathogens in the Body Fluids</th>
<th>Type of Infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Blood</td>
<td>Strplococci, HIV/AIDS, Bacteriaemia, Candidiasis, Viral Hepatitis</td>
</tr>
<tr>
<td></td>
<td>Staphylococcus sp.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Human Immunodeficiency virus (HIV)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Staphylococcus aureus, Enteroberater, Enterococcus,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Escherichia coli</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Candida albicans</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hepatitis B and C virus</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Jara, Lassa, Ebola and Marburg viruses</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Faeces and/or vomit</td>
<td>Typhoid, dysentry, worms, Viral Hepatitis</td>
</tr>
<tr>
<td></td>
<td>Salmonella, Shigella sp.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vibrio cholera, helminthes, hepatitis A virus (Faeces only)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Saliva</td>
<td>Respiratory tuberculosis, Measles</td>
</tr>
<tr>
<td></td>
<td>Mycobacterium tuberculosis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Measles virus</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Streplococcus pneumonia</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Pus</td>
<td>Skin infections</td>
</tr>
<tr>
<td></td>
<td>S. K. et al.</td>
<td></td>
</tr>
</tbody>
</table>

Table-3. List of pathogens in the body fluids and diseases transmitted through Bio-Medical Waste

Table-4. Toxic effects of some chemicals of Bio-Medical Waste

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Chemicals</th>
<th>Use</th>
<th>Toxic Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Boric Acid</td>
<td>Antiseptic, mouth wash, eye wash</td>
<td>Vomiting, diarrhoea</td>
</tr>
<tr>
<td>2</td>
<td>Ethanol</td>
<td>Antiseptic, Disinfectant</td>
<td>CNS depression, respiratory depression, dermal irritation</td>
</tr>
<tr>
<td>3</td>
<td>Formaldehyde</td>
<td>Disinfectant, Exfoliate, uses in cleaning</td>
<td>Gastroenteritis, CNS depression</td>
</tr>
<tr>
<td>4</td>
<td>Chlorine</td>
<td>Disinfectant</td>
<td>Irritant</td>
</tr>
<tr>
<td>5</td>
<td>Ethylene Oxide</td>
<td>Sterilant</td>
<td>Irritant, CNS depression, Carcinogen,</td>
</tr>
<tr>
<td>6</td>
<td>Organic Mercurial</td>
<td>Antiseptic</td>
<td>Ill effects on CNS and renal system</td>
</tr>
<tr>
<td>7</td>
<td>Iodine</td>
<td>Antiseptic</td>
<td>Gastroenteritis</td>
</tr>
<tr>
<td>8</td>
<td>Iodide</td>
<td>Expectorant</td>
<td>Iodism</td>
</tr>
<tr>
<td>9</td>
<td>Chlorates</td>
<td>Antiseptic, mouth wash, toothpaste</td>
<td>Hemolytic anaemia, Renal failure</td>
</tr>
<tr>
<td>10</td>
<td>Hydrogen peroxide</td>
<td>Disinfectant</td>
<td>An embolii</td>
</tr>
<tr>
<td>11</td>
<td>Potassium</td>
<td>Antiseptic</td>
<td>Manganese elevation, Methemoglobinemia</td>
</tr>
<tr>
<td>12</td>
<td>Phenol</td>
<td>Disinfectant</td>
<td>Dermal burns, Cutaneous absorption, CNS disturbance</td>
</tr>
</tbody>
</table>

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