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Biomedical waste management in Sonam Norbu Memorial Govt. District Hospital Leh-Ladakh

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Abstract

In present study attempt has been made to assess generation and management of biomedical waste at Sonam Norbu Memorial Govt. District Hospital Leh-Ladakh. The study revealed that in the hospital 267.7 g per bed per day of BMW is generated and hospital has adopted Biomedical waste management rule 2016 partially because so far as collection of Biomedical waste is concerned hospital is using four colour dust bins in all the wards, blood bank, laboratory and OPD whereas after collection the disposal of biomedical waste is not done as per BMW rule 2016.

Key Words: Biomedical waste, collection, management dust bins

Introduction

Waste generated from the hospitals, health care centres, medical research institutions, blood banks, medical laboratories, etc is called biomedical waste (Patil and Pokhrel, 2005). Bio-Medical waste mean any waste, included in the ten categories mentioned in schedule I of BMW rule 1998, which is generated in color coding bin mention in schedule II during the diagnosis, treatment or immunization of human being or animals or in research activities pertaining or in the production or testing of biological organism (Bio-Medical Waste Rules 1998 Of India, MOEF 20 July 1998). As per BMW Rule 2016 "Bio-medical waste" means any waste, which is generated during the diagnosis, treatment or immunization of human beings or animals or research activities pertaining thereto or in the production or testing of biological or in health camps, including the categories mentioned in Schedule I Biomedical waste pose hazard due to infectivity as well as toxicity. Biomedical waste differs from other types of hazardous waste, such as industrial waste. Hospitals are one of the complex institutions which are frequently visited by people from society without any distinction between sex, age, race and religion. Biomedical waste is a heterogeneous mixture, which is very difficult to manage as such. A major issue related to present biomedical waste management is that many dispose their waste in an improper, biohazard and indiscriminate manner which contribute to spread of serious diseases. There is lot of confusion with the problem among the generator, operator, decision maker and the general community for the safe management of biomedical waste. Almuneef and Memish (2003). Soil pollution from biomedical waste is caused due to infectious waste, discarded medicines, chemicals used in treatment and ash and other waste generated during treatment processes .Element including heavy metals in soil are harmful to animal and human being (Mehta 1998). Common diseases like Tuberculosis, Pneumonia, Diarrheal, Tetanus, Whooping cough etc; are spread due to improper waste management (Chitinis *et al.* 2002;Tudor *et al.* 2005).The Ministry of Environmental and Forest established the Biomedical Waste Management and Handling rule in 1998 under the Environment Protection Act (Moef webpage:http:/env for.nic in.). According to these rules it is the duty of every "Occupier i.e a person who has control over the institution or its premises, to take all step to ensure that waste generated is handled without any harmful impact to human and environment.The ministry of Environment & Forest and climate change amended the BMW management rule 1998 and name as a BMW management rule 2016 under environment protection act 1986 which has come to forced on 28 march 2016. These rule shall apply to all person who generate, collect, receive, store,

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transport, treat, dispose or handle biomedical waste in any form including Hospital, nursing home, clinics, dispensaries, veterinary institution, animal home, pathological lab, blood bank, Ayush hospital, clinical establishment, research or education institution, health camp, medical or surgical camp, vaccination camp, blood donation camp, first aid room of school, forensic, laboratories, and research lab. These rule shall not be applicable to radioactive waste as covered under the provision of the atomic energy act 1962,hazardous waste covered under the manufacture storage and import of hazardous chemical 1989,solid waste covered under the Municipal solid waste Management and Handling rule 2000, Lead acid batteries Management and Handling rule 2001, waste covered under the e-waste 2011. The wastes generated from health care units are generally classified as infectious and non-infectious. The biomedical waste which is infectious is termed as hospital waste and is considered to be potentially hazardous in nature. Hospital waste is highly infectious and can be a critical problem to human health if not managed in proper and discriminate manner Rastogi *et al.* (2011). In present study attempt has been made to assess generation and management of Biomedical waste at SONAM NORBU Memorial Govt Distt Hospital Leh .It is located at latitude 34º 10′ N and longitude of 77º 35′E at altitude and elevation of 3514m(11529ft). In this hospital treatment is given local people of leh district as well as people from outside the state of J&K and people from outside India as a Labourer or Visitor .In spite of harsh climatic condition this hospital provide healthcare facilities to all people around world with best effort of doctor and healthcare staff .In this hospital there is a separate ward for tourist from other state and other countries, but this tourist ward is open at time of tourist season and close at end of tourist season i.e. 1st week of November. In 2015 this hospital got 1st Prize in field of cleanliness and infection control from out of all the district hospital of J&K state (winner of KAYAKALP award). However shortage of doctors and health care staff in this hospital acts as a main constraint. After the launch of the NRHM programme the health care, as well as the facilities at health centre has dramatically improved in this hospital.

Materials and Method

The hospital was divided into six sites:

Site I: OPD (Immunization i.e MCH, Dental, Integrated counseling and training centre i.e ICTC.

Site II: IPD(Orthopaedic, Surgical, Eye/ENT, Geriatric ward, Medical ward, Tourist ward and VIP ward.

Site III: Mother and Child block.(Labour room, Gyanae, Pediatrics, Post Natal, Antenatal Ward.

Site IV: Blood Bank and Laboratory.

Site V: OT and MOT. (Operation theatre, Minor OT).

Site VI: ICCU(Intensive cardiac care unit.)

The study was carried out for three months i.e October, November and December, covering Nine Mondays, Nine Tuesdays, Nine Wednesdays, Nine Thursdays, Nine Friday, Nine Saturdays, Nine Sundays. During each sampling hospital waste generated in Yellow bin, Blue bin, Red bin and white bin at different sites of hospital during 24 hours period was collected, segregated and weighed to observe quantitatively composition of waste in each bin at each site.

Segregation of waste in yellow bin comprising (Placenta, Cotton swab, Dressing and plaster, and Blood bag), in Blue bin comprising (Injection vial, Ampoule, Test tube, Glass slide,), In Red bin comprising (Glucose bottle, Gloves ,Catheter, Dropper, Water bottle, Syringes, Needle cap, Drip set, HBs kit and in White bin comprising (Needle, Blade, Metallic lid of vial ,Lancet etc. was done mechanically by hand wearing gloves. For quantitative composition of the biomedical waste the average weight of biomedical waste item (cotton swab. dressing plaster, placenta, blood bag, injection vial, ampoule, syringes, needle cap, drip set, HBs kit, needles, blade. metallic lid of vial, lancet) was calculated by weighing 10 item using Digital weighing balance and spring balance then average weight of specific item in specific dust bin was multiplied by the total number of specific biomedical waste item in specific dust bin. The average no. of patient at all study sites (OPD as

well as Inward Patient, Blood bank, OT, MOT, Laboratory, Mother and child block) were also recorded to calculate average biomedical waste generation per capita per day with standard deviation.

Results and Discussion

The overall observation revealed that collection of Placenta, Cotton swab, Dressing / plaster and Blood bags is done in yellow bin, collection of Injection vials, Ampoules, Test tubes, Glass slides is done in blue bin, collection of Glucose bottles, Gloves,Catheters, Droppers, Water bottles, Syringes, Needle caps, Drip sets, HBs kits is done in red bin and collection of Needles, Blades, Metallic lids of vial ,Lancets is done in white bin as per BMW 2016.The critical analysis of data of BMW further revealed that composition of BMW in different color of dust bins at different sites of study area exhibited variations in percentages i.e. At OPD 66% BMW was used to be collected in red bin followed by 16% in yellow bin, 17% in blue bin, and 1% in white bin .At IPD 69% of BMW collected in red bin followed by 22% in yellow bin and 8% in blue bin and 1% in white bin.At Mother and child block 58% waste used to be collected in yellow bin followed by 37% in red bin 5% in blue bin and 0% in white bin . At Blood bank and Lab 63% was used to be collected in red bin and 19% in yellow, 14% in blue bin ,4% in white bin.At OT and MOT 56% was used to be collected in yellow followed by 39% red bin 5% in blue bin and 0% in white bin.At ICCU 73% collected in red, 14% in blue, 12% in yellow,1% in white bin (Table I).

Overall in a study area 40% of BMW was collected in Mother and Child block 33% in IPD,13% in OT and MOT. 5% each at ICCU and OPD, 4% in Blood bank and laboratory. Of all the four color dust bin 53% was collected in yellow bin followed by 37% in red bin ,9% in blue bin and 1% in white bin and total 15405.95g i.e. 15.4 kg/day of BMW is generated at the study area and this rate 107841.65g i.e. 107.8 kg per week, 462178.5g i.e. 462.1 kg per month and 5546142g i.e. 5546.4 kg per year is generated in study area.(Table I). The analysis of qualitative and quantitative composition of average per capita /day generation of biomedical waste in white bin at different sites of study area revealed that a total of 17.82g per capita/day of biomedical waste is generated in white bin and Mother and Child block contributed maximum of 10.8 g per capita /day of the waste and OPD contributed minimum of 0.27g per capita/day of biomedical waste. On qualitative basis needles contributed maximum of 49.77% and lancet contributed minimum of 2.13%.(Table II)

The critical analysis of average per capita per day data further revealed that within yellow bin 81% waste was represented by Placenta followed by 10% cotton swab,6 % blood bag and 3% dressing and plaster.Within the blue bin 85% biomedical waste was represented by injection vial followed by 14% of ampoule and 1% of test tube and 0% of glass slide. .Qualitatively in red bin glucose bottle contributed maximum of 43% followed by 16% of syringes,16 % of water bottles,14 % of drip set, 6% of gloves,3 % of needle cap and 1% of HBs kit. Within white bin 49% of BMW was contributed by needles followed by 46% metallic lid of vial , 3% of Blade and 2% of Lancet (Table II).The critical analysis of data average per capita of BMW further revealed that composition of BMW in different color of dust bins at different sites of study area exhibited variations in percentages i.e. At OPD 68% of per capita BMW was used to collected in red bin followed by 16% in blue bin ,15% in yellow bin,1% in white bin . At IPD 67% of per capita BMW collected in red bin followed by 23% in yellow bin and 9% in blue bin and 1% in white bin. At mother and child block 86% of per capita waste used to be collected in yellow bin followed by 8% in blue bin 5% in red bin and 1% in white bin .At OT and MOT 56% of per capita waste was used to be collected in yellow followed by 38% in red bin, 5% in blue bin and 1% in white bin. At Blood bank and Lab 61% of per capita waste was used to be collected in red bin and 21% in yellow, 14% in blue, 4 % in white bin. At ICCU 74% of per capita waste collected in red, 13% in blue, 12% in yellow, 1% in white bin (Table II).The critical analysis of average per capita data revealed that yellow bin contributed 78% i.e. 383.67g per capita /day of biomedical waste followed by red bin contributing 11 % i.e. 51.91g per capita /day, blue bin contributing 10.% i.e. 49.63 g per capita/day and white bin contributed the minimum of 1 % i.e. 4.45g per capita /day(Table II) Overall in a study area on an average 0.122 kg per capita/day and 0.267.kg per bed per day of BMW is

Table: I Total quantitative composition of biomedical waste per day generated in colour bin at different site of study area

Colour coding bin	Total average biomedical waste(g per day) at Sites						
	OPD	**IPD**	**Mother & child block**	**Blood bank &lab.**	**OT/MOT**	**ICCU**	**Total average per day at study area**
Yellow	115.81	1099.1	5563.76	119.73	1111.86	99.14	8109.65(52.63%)
Blue	124.4	432.63	502.95	85.4	103.21	114.53	1363.13(8.84%)
Red	479.41	3528.16		388.19	777.97	618.27	5792(37.59%)
White	11.2	40.39	46.15	22.3	13.2	7.93	141.17(0.91%)
Total	730.82g (4.7%)	5100.28g (33.10%)	6112.87g (39.67%)	615.62g (3.99%)	2006.24g (13.02%)	839.87g (5.45%)	15405.95g. (100%)

Table:II Total quantitative composition of biomedical waste per capita per day generated in colour bin at different site of study area.

Colour coding bin	Total average biomedical waste(g per capita /day) at Sites						
	OPD	**IPD**	**Mother & child block**	**Blood bank & lab.**	**OT/MOT**	**ICCU**	**Total average per capita / day at study area.**
Yellow	2.7	29.12	1324.1	3.98	129.27	43.1	383.6(78.35%)
Blue	2.99	11.53	119.6	2.71	12	49.7	49.63(10.13%)
Red	12.68	84.54		11.71	88.33	268.79	51.91(10.60%)
White	0.27	1.07	10.8	0.72	1.53	3.43	4.45(0.90%)
Total	**18.64g**	**126.26g**	**1454.5g**	**19.12g**	**223.71g**	**342.62g**	**489.59/4=122.26g**

Table:III Total quantitative composition of biomedical waste per Capita/ day generated in colour bin at different site of study area.

Colour coding bin	Total average biomedical waste(g per Capita /day) at Sites						
	OPD	**IPD**	**Mother & child block**	**Blood bank & lab..**	**OT/MOT**	**ICCU**	**Total average per capita /day at study area**
Yellow	115.81	1099.1	5563.76	119.73	1125.8	117.41	8142.14/127.2=64.01g
Blue	124.4	432.63	502.95	85.4	103.21	114.53	1363.13/127.2=10.73g
Red	479.41	3528.16		388.19	777.97	618.27	5792/127.2=45.53g
White	11.2	40.39	46.15	22.3	13.2	7.93	141.17/127.2=1.10g
Total	**730.82g**	**5100.28g**	**6112.87g**	**615.62g**	**2020.18g**	**858.14g**	**122g**

Note: 127.2 is total average per day patient.

Table: IV Total quantitative composition of biomedical waste per bed per day generated in color bin at different site of study area.

Colour coding bin	Total average biomedical waste(g per bed /day) at Sites				
	IPD	**Mother & child block**	**OT/MOT**	**ICCU**	**Total average per bed/ day at study area.**
Yellow	1099.1	5563.76	1125.81	117.41	7903.08/52.6=150.24g
Blue	432.62	502.95	103.21	114.53	1152.32/52.6=21.90g
Red	3528.16		777.97	618.27	4924.4/52.6=93.61g
White	40.39	46.15	13.2	7.93	107.59/52.6=2.04g
Total	**5100.27g**	**6112.86g**	**2020.19g**	**858.14g**	**267.79 g**

Note:-52.6 is average total patient.

generated (Table III and Table IV). This observation seems to be contradictory to work of Malik 1997, Da silva *et al.* 2005, Pandey and Chaplot 2005, Patil and Pokhrel 2005, Bassey *et al.* 2006, Patil and Shekdar 2007 , Khurshid and Mathur 2010 , Abah, and Ohimain 2011, who reported that hospitals in India generate hospital waste in the range of 0.5 Kg to 2.78 kg per bed per day. But in present work only biomedical waste collected in four color dust bin has been recorded and the non bio -medical waste collected in black dust bin has not be recorded as per BWM 2016 while other workers studied hospital waste following BWM 1998 that included the non biomedical waste of black bin into account. .

Biomedical waste management consists of segregation, collection, transportation, treatment and disposal. Biomedical waste generated on holiday is not collected from all the wards of hospital. Segregation of hospital waste at SNM Hospital was almost proper and waste were segregated at the source of generation according to BMW rule 2016 and used to keep the waste in specific color coding bin i.e. yellow, red, blue, white so as to reduce the risk of infection and time to be consumed in segregation of waste after collection. For collection, the color coding bin were placed at a location where maximum collection was achieved. Needles, sharps are used to be placed in bleaching powder container which of white colour instead of white bin because of its non availability at Leh market. Hospital was having a shredder room where plastic waste are used to be shredded and store for their sale to scavenger for some amount who carried it to Srinagar for recycle. Rao *et al.(*2004) also suggested that all disposable plastic should be subjected to shredding before disposing off to vendor and final treatment of medical waste can be done by technologies like incineration, autoclave, hydroclave or microwave.

Biomedical waste of this hospital is used to be manually loaded and there was no facilities of trolley or covered wheel barrow. Waste collector of this hospital use to carry the waste manually from one ward to another thereby exposing themselves to risk of infection Abdul *et al.*2003 while studying 44 clinical laboratories of Karachi observed that gloves and protective gown used as personal protective's clothing did not provide sufficient protection to the waste handler against the hazardous biomedical waste and emphasized that suitable protection from the risk must be provided to health care workers.

In the hospital needles, sharps, cotton, dressing/plaster, syringes, vial, broken ampoules etc are used to be first treated with chemical that act as disinfectant like bleaching powder .For thermal treatment though incinerator is available but not used due to low quantity of waste generation of per day. Autoclave was found to be non–functional .Mechanical treatment is done to reduce volume of waste and shredding is done to destroy plastic and paper waste. No biological and radiation treatment was done there.

After treatment, biomedical waste of SNM hospital is disposed off. A needles, sharps are used to put in sharp pit and there are also a placenta pit to treat placenta with disinfectant. Chemically disinfected gloves, cotton, vial, dressing/plaster were loaded by municipal committee vehicle Leh and finally disposed off openly at area called Bomb Guard where both municipal waste of Leh district and treated hospital waste were disposed off. Patil (1997) also reported co disposal of hospital waste with municipal waste in Raurkela's. Almuneef and Memish 2003 reported that affective hospital waste management is not done due to lot of confusion with the problem among the generator, operator, decision maker and the general community about the safe management of biomedical waste. This waste is taken by dogs , cows and rag pickers also visit for collection of plastic waste. Moreover the slaughter house near to disposal site also dispose off skin and wool of sheep and goat which attract the dogs and disposal site has become the breeding ground for germs and vectors. Akter 2002 stressed upon need to improve handling and disposal methods of hospital waste in Bangladesh to reduced the probable health effect of hospital waste. Manyele (2004) reported that improper management of medical waste caused serious environmental problem in term of air, water, and land pollution. Liquid waste generated from all the sites of study area were first treated with bleaching powder and then directly dispose off in sink/drain as there was no separate plant for liquid treatment in this hospital. The analysis of Awareness status of Biomedical waste and its management among Doctors, Healthcare staff and students at study area reveal that all the respondent were not fully awared

about the biomedical waste management as per BMW 2016 Nagarrajan *et al.* (2005) also observed significant gap in the Knowledge, Attitudes and Practices of the consultant, resident and scientist with regard to BMW disposal They recommended subject intensive training program to increase awareness and practices in the people. Pandit *et al.* (2005) in a crossectional study of 30 hospital from Sabarkantha district, Gujarat observed that was an immediate and an urgent need to train and educate all doctor and the staff to adopt effective waste management practices. Gupta and Shantmanu(2016) crossectional study among 89 with predesigned semi structural questionnaire they concluded that there was lack of knowledge regarding management of biomedical waste among health worker.

Desmukh and Rathod (2016) Biomedical waste management is one of the biggest challenge of present day time due to it direct impact on the health of the citizen of that city. Overall observation of the SONAM NORBU Memorial Hospital i.e (Govt District Hospital Leh) revealed that hospital has adopted Biomedical waste management rule 2016 partially because so far as collection of Biomedical waste is concerned hospital is using four colour dust bins in all the wards, blood bank, laboratory and OPD whereas after collection the disposal of biomedical waste is not done as per BMW rule 2016.

Recommendations

- Waste bags/containers should be properly sealed and labeled. Biomedical waste generated on holiday should be collected from all the wards of hospital.
- Bags should not be filled completely, so that bags can be picked up by the neck again for further handling.
- Manual handling of waste bags should be avoided to reduce the risk of needle prick injury and infection.
- Clean the color coding dust bin daily including the lid with an appropriate disinfectant or water.
- Hospital Waste bags should be carry in a trolleys or wheel barrow.
- Bio plastic bag should be put in the container so that bins are durable for long period of time.
- Avoid to put hand in liquid waste while segregating the gloves from it .
- If waste will incinerate then no need to disinfect with bleaching powder except laboratory waste.
- Do not mix the treated or untreated hospital waste with general waste which are transported by municipalities vehicle.
- Waste should be collected daily whether waste quantity is high or low in color bins ,avoid waiting till the bin is fulfill.
- There should be a separate landfill for treated biomedical waste so as to avoid mixing of municipal waste with treated hospital waste.
- Avoid putting medicine vials in sharp pit, and these should be separately collected.
- Biomedical waste management related topics should be put in syllabus of paramedical students of this hospital.
- Liquid waste should be treated before disposing off.
- Good quality type of gloves should be provided to sweeper and boomer.
- Incinerator should be set up at area away from market and residential area because gases releases from incinerator are carcinogenic in nature.

Health staff as well as attendant of patient should be fully aware to management of biomedical waste

- waste bin must be with proper lid
- Avoid segregation of biomedical waste at open area.
- .Health education to everyone.

Seminar/awareness campaigns should be conducted to aware the peoples.

- Color coding bins should be kept at the place where maximum waste collection is possible.
- Training on biomedical waste handling and management should be conducted in hospital annually.
- Mask and Non- chlorinated gloves should be used while collecting or segregating the biomedical waste. Later gloves could be incinerated.
- Slaughter house should be away from waste disposal site so as to reduce risk of infection

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