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ASSESSMENT OF CURRENT PRACTICES OF BIOMEDICAL WASTE MANAGEMENT IN SELECTED HOSPITALS OF AJMER CITY, RAJASTHAN (INDIA)

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ABSTRACT

Handling and disposal of wastes has become a big task due to growing urban population. Improper disposal has become one of the challenging problems of urbanization. The study was conducted to determine the biomedical waste management system in selected hospitals of Ajmer City. The key to minimization and effective management of health-care waste is segregation and identification of the waste. Appropriate handling, treatment, and disposal of waste by type reduce costs and do much to protect public health. This study was done to survey the practice of biomedical waste such as collection, storage, transportation and disposal along with the amount of generated biomedical waste in various government hospitals of Ajmer city, and create awareness among the staff and patient about biomedical wastes through questionnaire. Bio-medical waste is one of more serious and hazardous environmental pollutants and if it is not disposed off with proper management it could produce large number of infectious diseases which would be harmful to livelihood of human beings & other living organism. A detailed Field visit, Interview and questionnaire survey method were implemented to collect information regarding different biomedical waste management aspects, including medical waste generation, segregation and collection, storage, transportation, disposal and safety of cleaning personnel. During study it was observed that waste is not collected at regular interval. The Segregation of hospital waste plays the key role in the safe and efficient management of biomedical waste, especially infectious wastes from the non-infectious waste. Proper segregation of this waste at hospitals is recommended.

KEYWORDS: Biomedical, Hazardous Environmental Pollutants, Infectious Diseases, Segregation.

INTRODUCTION

A major issue related to current Bio-Medical waste management in many hospitals is that the implementation of Bio-Waste regulation is unsatisfactory as some hospitals are disposing of waste in a haphazard, improper and indiscriminate manner. Lack of segregation practices, results in mixing of hospital wastes with general waste making the whole waste stream hazardous. Inappropriate segregation ultimately results in an incorrect method of waste disposal. A bag not securely tied results in scattering of Bio-Medical waste. Bio-Medical waste scattered in and around hospitals invites flies, insects, rodents, cats and dogs that are responsible for spread of communicable diseases like plague and rabies. Most importantly there is no mechanism to ensure that all waste collected and segregated, reaches its final destination without any pilferage. Additional hazard includes recycling of disposables without even being washed.[1]

According to World Health Organization (WHO) some part of healthcare wastes are considered most hazardous that can affect human health and pollute the environment badly.[2-5]

However, inadequate management practices are often implemented in most healthcare facilities (HCFs) particularly in developing countries.[6,7] A number of studies on healthcare wastes management reported that health and environmental risk posed by healthcare waste can be reduced by having careful planning, proper guideline and full participation of HCWs.[8-13]

Usage of same wheel barrow for transportation of all categories of waste is also a cause of infection spreading. Most of the times there is no monitoring of trolley routes, resulting in trolley movement around patient care units posing a serious health hazard.

There is no mechanism for ensuring waste treatment within prescribed time limits. Note that, Bio-Medical waste if not handled properly and within the stipulated time period could strike in the form of fatal infections. In some hospitals there is no proper training of the employees in hazardous materials management and waste minimization aspects. This indicates the lack of even basic awareness among hospital personnel regarding safe disposal of Bio-Medical waste.

Awareness regarding biomedical waste management is very less among health care personal. The health care workers play a very important role in biomedical waste management; hence they should have thorough knowledge and practice to provide safety and safe environment including protection.[14]

Definition of Biomedical Waste

As per Biomedical Waste (Management and Handling) Rules, 1998 of India, BMW is defined as "Any waste generated during the process of diagnosis and treatment or immunization of human beings or animals or in research activities contributing to the biological production or testing" (Govt. of India, 1998).[15] One of the major achievements of India has been modification of the health operators' attitudes to accommodate in waste management concerning health care nicely in their operation routinely.[16]

Classification of Biological Wastes

1. **Non–Hazardous Wastes**

In most of the set–ups of health–care approximately 85% of generated wastes is constituted by non–hazardous wastes. This includes wastes constituting remnants of food and peels of fruit; wash water as well as paper cartons; packaging materials etc.[17]

2. **Hazardous Wastes**

In the scientific documents as well as in the regulations and guidance various terms for infectious wastes have been used over the years. These include: infectious as well as infective; medical and biomedical; hazardous and red bag; contaminated; infectious medical wastes; along with regulated wastes in the medical profession. Basically all these terms indicate the similar types of wastes even though the terms involved in regulation are defined usually in more specific manner.[18]

Hazards of biomedical waste are as follows

According to the World Health Organization (WHO), the global life expectancy is increasing year after year. However, deaths due to infectious disease are increasing. A study conducted by WHO in 1996, reveals that more than 50,000 people die everyday from infectious diseases.

Source: Kishore, J.; Ingle, G.K., 2004.

Table 1: Showing potential hazards due to waste material.

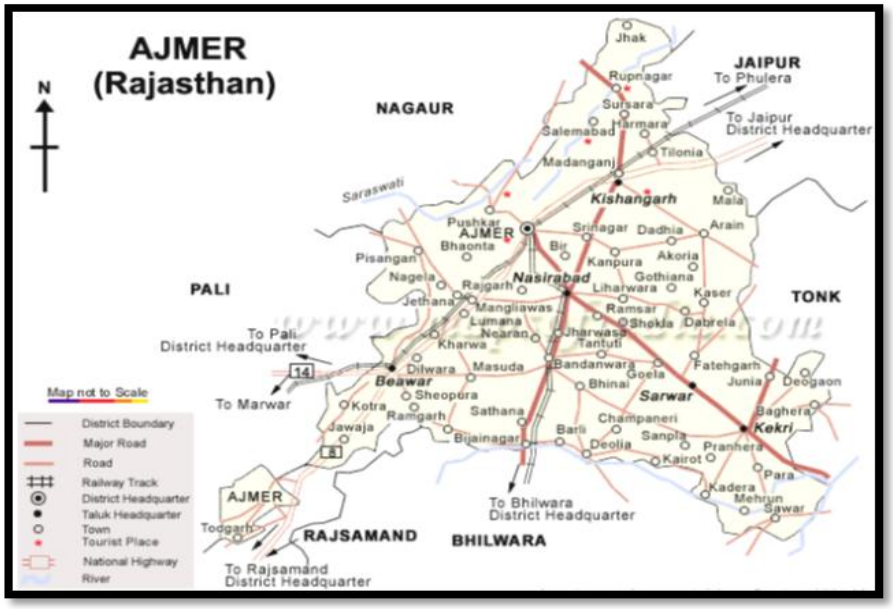
S.No	Potential Hazards	Waste Materials
1	Psychological Stress	Human Anatomical waste,
2	Infections and Diseases: HIV/AIDS, Hepatitis B &C, Hemorrhagic fever, Herpes, Measles, Shigellosis, Salmonellosis, Pneumonia, Septicemia, Bateraemia, Cholera, Tuberculosis, Anthrax, Helminthicinfections, Candidiasis and others	Human Anatomical waste, Soiled Waste, Microbial/ Biotech waste, Sharps,
3	Infections: Rabies, Anthrax, and Other	Animal waste
4	Injuries	Sharps, cytotoxic & Radioactive dmgs, Incinerator waste;
5	Dermatitis, Conjunctivitis, Bronchitis,	Chemical, Cytotoxic, Radioactive, Incinerator wastes
6	Cancer, Genetic mutation	Cytotoxic, Radioactive drugs and materials, Chemical Wastes
7	Poisonings	Cytotoxic & other drugs, liquid & Chemical wastes

There are no national level studies on the quantity of hospital waste generated per bed per day, but studies have been carried out at local or regional levels in various hospitals. Whatever data are available from these studies, it can be safely presumed that in most hospitals, roughly 1-2 kg/bed/day of waste is generated. One study claims that the estimated quantity of the waste generated in the hospitals varies from 2-5 kg/bed/day.

STUDY AREA

The area under investigation Ajmer, formerly written Ajmer, is the city in Ajmer District in India's Rajasthan state. It is bordered by Nagaur District in the north, Jaipur and Tonk district in the east, Bhilwara district in the south and Pali district in the west. Surrounded by the Aravallis Mountains, Ajmer is also known as Ajaymeru, was the city once ruled by prithviraj Chauhan. Ajmer city is governed by Municipal Corporation which comes under Ajmer Metropolitan Region. As per provisional reports of Census India, population of Ajmer in 2011 is 542,321; of which male and female are 278,545 and 263,776 respectively. Although Ajmer city has population of 542,321; its urban / metropolitan population is 551,101 of which 283,072 are males and 268,029 are females.

AJMER	
Coordinates	26º16´N 74º25´E / 26.27ºN 74.42ºE
Country	India
State	Rajasthan
District(s)	Ajmer
Time Zone	IST (UTC +5:30)
Elevation	486 m (1,594 ft)



Source: Map of India.

Figure 1: Showing Ajmer City.

Now at present there is a big network of Health Care Institutions in Ajmer City. There are many Government, Non- Government Hospitals, Dispensaries, Research Laboratory, Clinics etc in the city where large amount of biomedical waste is generated daily. Until recent times, hospital waste in Ajmer city was not properly segregated before disposal to the dump or incinerator.

The Biomedical waste treatment and disposal are to be done very carefully, as it is infectious in nature. Considering the then level of information and knowledge, the Government of India has specifically laid down the treatment and disposal options.

All health care institutions are required to follow this without fail. As per the Rule, the biomedical waste has to be treated and disposed of in accordance with options suggested under Schedule I, and in compliance with the standards prescribed in Schedule V of the Rule.

AIMS

1. To assess practice of biomedical waste such as collection, storage, transportation and disposal along with the amount of generated biomedical waste in selected hospitals of Ajmer city.
2. To provide recommendations for proper BMW Management in hospitals.

Current Biomedical Waste Management Scenario in city

World Health Organization states that the total hospital waste generated, approximately 10% is hazardous, 85% is general (non risk) waste while a small percentage (5%) is labelled as highly hazardous. Currently, most of the biomedical waste is being disposed along with municipal solid waste. The untreated liquid waste from the health institutions is let into drainage. The prevalent solid waste management practices in the city are highly deficient. Storage of wastes at source is generally not attended to. Households, commercial establishments, industries, hospitals, and nursing homes, etc. keep on throwing the waste on the streets, footpaths, drains, etc. The biomedical waste has been grossly neglected in Ajmer. Large number of hospitals, nursing homes, health care centres has been identified by the State Pollution Control Board in Ajmer but do not take any measure for the safe disposal of the biomedical wastes. The biomedical wastes sometimes get mixed up with the municipal solid waste and deposited at the common disposal site. Wastes from operation theatres, wards and pathological laboratories are disposed of without any disinfection/sterilization.

MATERIALS AND METHODS

The present investigation was carried out during the 2015. A cross sectional study was conducted in three

government hospitals of Ajmer. The hospitals were visited and the presence or absence of waste management technique was noted. Survey of the hospitals was done in order to assess the type of facilities present in the hospitals. The survey included: to gather information about current disposal practices and to understand the present situation of hospital waste management by personal observation. Following Hospitals were selected for assessment of the biomedical waste management in Ajmer city. Though they all are big hospital of the city.

1. Jawaharlal Nehru Hospital
2. Govt Satellite hospital
3. Railway Hospital

Methods of storage and segregation at ward, department, internal transportation, external transportation and final disposal were studied for all three hospitals by direct observation and infrastructure for the same were studied. Informal discussion with various hospital functionaries were carried out. Common regional facility for final disposal of infectious waste was also observed. Though the Jawahar lal Nehru hospital is the largest hospital of Ajmer city the waste generation rate is also high as compare to other hospital.

Developing a questionnaire

To achieve the objectives of the research questionnaire was developed. The questionnaire will be developed in such a way that it provides all the information regarding Hospital Waste Management. Every hospital generating biomedical wastes needs to set up requisite treatment facilities to ensure proper treatment of wastes so as to minimize risk of exposure to staff, patients and the community to biomedical hazards. Safe and effective management of bio medical waste is not only a legal necessity but also a social responsibility.

RESULT DISCUSSION

1. Biomedical waste generation & segregation

Amount of Bio-Medical Waste generated in hospitals of city was calculated with the help of personal observation and questionnaire. The biomedical waste generated in the hospitals came from various activities performed in the hospitals. The amount of waste generated in hospitals depends upon various factors such as size of establishments, number of beds, types of health services provided, available waste segregation options, economic, social and cultural status of the patients and general condition of the area where the hospitals are situated. Though Jawahar lal Nehru hospital is situated in the middle of the city. The rag pickers and waste workers are often worst affected, because unknowingly, they rummage through all kinds of poisonous material while trying to collect items which they can sell for reuse. At the same time, this kind of illegal and unethical reuse can be extremely dangerous and even fetal. At some point it was revealed that in nearly half the patient care areas of the hospitals, containers with colored bags were not located at the site of generation. Inappropriate segregation methods were observed at some point in JLN hospital of the city (as shown in figure 2,3, 4,5). No body was found wearing an\ protective gears, spectacles, shoes and hand gloves even. These items are considered to be a luxury and were thought to hinder the work. Besides they complained that the same are not provided by their employers like hospitals and municipalities. At Railway hospital the containers are kept but the segregation method was not proper. (as shown in figure 6)

Figure 2: Ward of JLN hospital

Figure 3: Black bag kept in hospital but Segregation was not proper in JLN hopital

Figure 4: Blue container at JLN hospital

Figure 5: Yellow container at JLN hospital

Figure 6: The Red, Yellow and Blue Container placed at Railway hospital

The table no 2 showing category of waste, the wards of waste generation and the final disposal of waste. The non hazardous waste goes to municipal landfill site yet the hazardous waste taken up by the private waste management company from all the hospitals of the city. The table no 3 showing the types of facilities available in all the three hospital of the city.

Table 2: Showing final disposal method adopted by the hospital according to the type of waste generated.

Type of Wastes	Site of Generation	Final Disposal By
Non-Hazardous (General)	Office, Kitchen, Cafeteria, Billing, Administration, Cashier, Rest rooms, Pantries in wards, Stores, etc	Municipal Authorities
Hazardous (Infectious and toxic)	Wards, Treatment, room, nursing station, Isolation rooms, Operation theatres, Intensive Care Units and post operative recovery room, Minor OTs, Blood Bank Pharmacy and Medical Stores, All laboratories, Pharmacology OPDs' Injection rooms.	Common biomedical waste treatment facility (Private Waste Management Company.

Table 3: Types of wards and facilities available in hospital.

S.No	Wards	JLN	Govt Satellite Hospital	Railway Hospital
1.	Medical	Y	Y	Y
2.	Surgical	Y	Y	Y
3.	Operating Theatre	Y	Y	Y
4.	Intensive care	Y	Y	Y
5.	Isolation ward	Y	N	N
6.	Emergency	Y	Y	Y

7.	Autopsy room	N	N	Y
8.	Radiology	Y	N	Y
9.	Laboratories	Y	N	Y
10.	Biochemistry	Y	N	N
11.	Microbiology	Y	N	N
12.	Research	Y	N	N
13.	Pathology	Y	Y	N
14.	Blood Bank	Y	N	Y
15.	Kitchen	Y	N	Y
16.	Pharmacy	Y	Y	N
17.	Chest clinic (TB)	Y	N	Y
18.	Maternity Ward	N	N	Y
19.	Children Ward	Y	N	Y
20.	Zonal public health (Quality control) Food water testing	N	N	Y
21.	Gyneic Ward	N	Y	N
22.	Dental	Y	N	N
23.	ENT	Y	N	N
24.	Neurosurgery	Y	N	N
25.	Orthopedic	Y	N	N
26.	Cardiology	Y	N	N
27.	Urology	Y	N	N
28.	Eye	Y	N	N
29.	Mental ward	Y	N	N
30.	Private Room	N	N	N
31.	Labour Room	N	N	N
32.	Sonography	N	N	N
33.	Phototherapy Room	N	N	N
34.	MRI CT scan	N	N	N
35.	Video Endoscopy	N	N	N
36.	X-Ray	N	N	N
37.	Colonoscopy	N	N	N
38.	ECG, CTMT, EEG	N	N	N

2. Rate of Waste generation detail of selected hospitals of Ajmer city

The quantity of waste generated in health care settings should be known while making a good waste management system. Hence, the quantities of different categories of waste have to be estimated by discussions and interviews As mentioned in below table No 3. The approximate amount of Yellow waste 400kg/month, blue waste 300kg/month, 900kg/month black waste and 100kg/month red waste is generated in JLN hospital. The amount of waste generated in Satellite hospital were 152kg/month, 116kg/month and 100kg/month, 83kg/month is of Yellow, Blue, Black and red waste respectively. The railway hospital is of 206 beds, yet most of the patients visit this hospital for treatment in the city. The average waste generated is 271kg of yellow category, 58 kg of blue category and 82kg, 75kg is of black and red category of waste respectively. (Table 4). As shown in graph (Figure no 7) the JLN hospital has highest rate of waste generation than other two hospitals.

Table No 4: showing rate of waste generation in hospitals.

S.No	Name of Hospital	No of Beds	Approx waste generated/month (Average)			
			Yellow (kg)	Blue (kg)	Black (kg)	Red(kg)
1	JLN Hospital	918	400	300	900	100
2	Govt Satellite Hospital	50	152	116	100	83
3	Railway Hospital	206	271	58	82	75

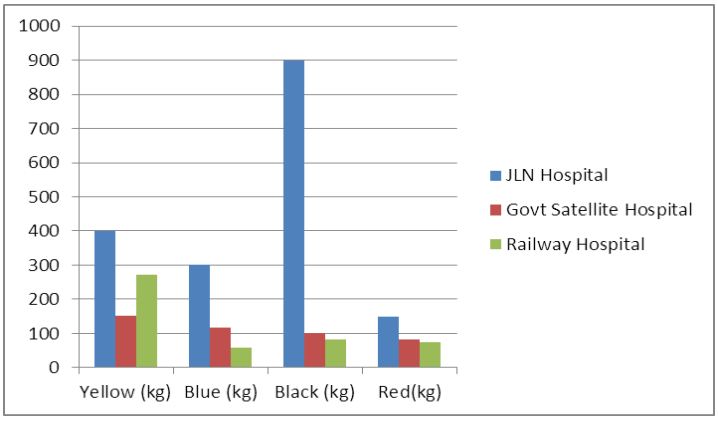


Figure No 7: Showing the comparison of waste generation between three hospitals.

3. Segregation, Collection & Transportation

The waste is segregated according to their characteristics mainly into the following categories: sharps, infectious waste, pathological waste & pharmaceutical waste. Although a system of colour coding or labelling of waste containers/bags has been adopted, not all services strictly follow the national regulations to practices the colour coding system. The biomedical waste is segregated into:

1. Infectious waste, pharmaceutical waste & chemical waste (Red bag)
2. Sharps (yellow bag)
3. Domestic waste (black bag)

Wastes are collected daily and transported to the designated central storage site. Transportation of waste within the establishment utilizes wheeled trolleys that are dedicated solely for the purpose. Not all workers transporting the waste are equipped with appropriate personnel protective equipment including heavy duty gloves, coveralls thick soled boots and leg protectors.

4. Treatment and Incineration

The infectious waste was treated via incineration. The benefits of controlled incineration of infectious wastes include volume reduction and the removal of pathogenic risk, as long as the system operates correctly. The drawbacks to incineration include the large capital and operating costs for modern technologies, the need for skilled labour to operate and maintain the system, the potential lack of local access to materials for incinerator construction, the required supplies (e.g. fuels) and the potential for toxic emissions to the air where there is no emission control equipment. Open burning (uncontrolled incineration) should be avoided, because of risks to workers, not only from uncontrolled toxic gas emissions to the air, but as well from infectious wastes that are only partially burned. After incineration, the final waste is deposited in a site and they are taken by the vehicle of the municipality for the landfill. However, non-infectious waste was discarded directly in a sanitary landfill of the city of Ajmer.

The common bio-medical waste treatment and disposal plant located at parbatpura was established. It was observed that the peoples which are directly involved in disposal and treatment procedure were not undergone any proper training program. They collect biomedical waste from hospitals of city. All the collected waste very first segregated according to the norms at the plant site. The waste is segregated without any precautions which can leads to harmful diseases. The plastic waste is transported for the recycling where as, the human and sharpen waste were subjected to incineration. Incineration was carried out at 8000Cto 11500C. The resultant ash latter dumped into the landfill area. The liquid waste generated was subjected for treatment. It was observed that the onsite workers related to segregation, incineration and dumping warred mask, glows and apron.

5. Biomedical waste management system in hospitals of Ajmer city.

1. *Waste Production:* Waste is generated from the various activities performed in the hospital. Wastes produced in the hospital include general and medical wastes. The amount of waste generated in hospitals depends upon various factors such as number of beds, types of health services provided, economic, social and cultural status of the patients and the general condition of the area where the hospital is situated.
2. *Waste Segregation:* The hospital basically separates medical waste from general waste stream at the waste production points. Therefore they are stored and disposed off separately. However, the hospital does not segregate medical wastes into different categories. In the wards, doctors and nurses who use sharps are required to drop them into different containers but this is not diligently followed. During our interview it was revealed that segregation of medical wastes into infectious medical waste and non-infectious medical waste is not conducted according to definite rules and standards. Separation of medical waste and general waste is however practiced to a satisfactory extent.
3. *On-site Transport of Medical Waste:* Medical wastes generated in the hospital are on a daily basis collected and transported to a temporary storage area by hospital's staff. It is mandatory for medical waste to be transported within the hospital by means of

wheeled trolleys, containers or carts that are not used for any other purpose. The staff employed for handling waste in the hospital use almost complete personal protective equipment, including overall gown and protective boots and gloves. Most of the hospital does not maintain a record/ register for medical waste disposal properly. The wastes are kept in this temporary storage area until it is time for off-site transport.

4. *Temporary Storage:* The wastes are kept in this temporary storage area until it is time for off-site transport. The infectious and non-infectious wastes are kept in separate containers and are not mixed together in the hospital's own temporary storage area. Incineration is the main method for the treatment of medical waste especially infectious and sharp wastes for the hospital. Autoclaves are used for treating part of the wastes. (Fig:8,9).

Figure No 8: Showing temporary storage area at Railway hospital

Figure No 9: Showing Incinerator which is not in working condition

5. *Off-site Transport of Medical Waste:* Offsite transport of the hospital waste is undertaken by a waste management company and waste is transported daily. (figure 10,11).

Figure No 10: Showing Biomedical waste vehicle of private company

Figure No 11: Showing incinerator at CBMWTF of Ajmer

RECOMMENDATIONS FOR PROPER BMW MANAGEMENT IN HOSPITALS

1. For the use of incinerator Training should be given to some number of persons from staff.
2. Specific fund should be allocated for the use of incinerator.
3. Every hospital should have special boxes to use as dustbin for bio- medical waste.
4. Bio-medical waste should not be mixed with other waste of Municipal Corporation.
5. Private hospitals should also be allowed to use incinerator, which is installed, in govt. hospital. For this purpose a specific fee can be charged from private hospitals.
6. Special vehicle i.e. bio-medical waste vehicle should be started to collect waste from private hospitals and private medical clinics and carry it up to the main incinerator.

7. As provided by bio-medical waste rules, the whole of the waste should be fragmented into colours due to their hazardous nature.
8. Bio-medical waste Management Board can be established in each District.
9. Either judicial powers should be given to the management board or special court should be established in the matters of environment pollution for imposing fines and awarding damages etc.
10. Housekeeping staff wear protective devices such as gloves, face masks, gowned, while handling the waste.
11. There is biomedical waste label on waste carry bags and waste carry trolley and also poster has put on the wall adjacent to the bins (waste) giving details about the type of waste that has to dispose in the baggage as per biomedical waste management rule. Carry bags also have the biohazard symbol on them.

CONCLUSION

During the past few years, there has been an increase in the level of public concern about the management of healthcare wastes (HCW) on a worldwide basis. Healthcare activities lead to the production of wastes that may cause adverse health effects. Despite the efforts for the management of wastes, the current system of healthcare waste management in the hospital of Ajmer city is under development and is in dire need of immediate attention and improvement. There is still a lack of specialized services for the collection and final disposal of health care wastes in the hospital of Ajmer. Thus, the wastes are not properly segregated, collected and disposed in all the services of the hospital, which may lead to a negative impact on public health and on the environment. Finally, the storage, transport and treatment of HCW will have to comply with current regulations and all personnel involved must be properly trained to avoid injuries and accidents. Through the primary and secondary studies, infrastructure deficiencies have been found in Ajmer city. On the basis of understanding the study seeks to improve the current scenario of Ajmer with respect to solid waste management in general and biomedical waste management in specific.

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