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Assessment of Knowledge and Attitude towards Management and Disposal of Radioactive Waste

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ABSTRACT

Radioactive waste operation refers to the safe treatment, storehouse and disposal of liquid, solid and gas discharge from hospitals and conventions with the thing of guarding people and the terrain. Radioactive waste is a dangerous type of waste. This contains radioactive material. The storehouse and disposal of radioactive waste is regulated by government agencies in order to cover mortal health and the terrain. Radioactive wastes of colorful types results from any exertion that makes use of nuclear accoutrements, including medical and artificial uses. Whatever their origin is, radioactive wastes have to be managed safely and economically.

Introduction

Radioactive waste is generated in hospitals and conventions in the form of solid, liquid &semi-liquid. Radioactive wastes are created by radiations like gamma shafts, nascence- shafts, beta shafts, etc.(1) These wastes are dangerous to mortal health, because they can beget systemic diseases, skin becks, eye cataract, etc. They also help in opinion of the complaint. These are unhealthy for the mortal body if they're in contact with the body for longer duration. That is why they should be handled and discarded well.

In hospitals and conventions, the introductory radioactive waste operation starts by separating them in different bins. The radioactive waste of biohazardous cases should be kept independently. The waste should be carried in a separate vehicle. As the introductory operation starts in hospitals and conventions they're treated with chemicals so that they can pass on for further operation. The operation starts by treating it with chemical treatment. The semi-liquid & liquid waste like inventor and fixing result should be changed in a regular interval of time in 3 months. All the safety preventives should be taken to avoid any detriment. A 6 bases of distance should be there between the X-ray machine and the person who's shooting the X-ray. To check the diurnal cure of exposure one should wear the film emblem regularly.

In general, radioactive waste is separated into 3 orders 1) Low- position waste (LLW) (similar as paper, rags, tools, apparel)(short lived radioactivity) 2) Intermediate- position waste(ILW)(Advanced quantities of radioactivity and requires some shielding) 3) High- position waste(HLW)(largely radioactive and hot due to decay heat, so requires cooling and shielding). depending on its position of radioactivity and the length of time it remains dangerous. Disposal of LLW and utmost ILW is mature practice, while utmost HLW is safely stored in devoted installations. The endless disposal of HLW in deep geological depositories is accepted to be practicable by the scientific and specialized community, but has yet to be accepted by civil society in numerous countries. The conditioning necessary for managing radioactive waste duly can be distributed into following way

- Minimizing the quantities created

- Exertion and packaging to permit safe running and protection during transport-Interim storehouse

-Final disposal

The radioactive waste must be stored before disposal and it depends on the type of waste and radioactive isotopes it contains. For shorter time the radioactive waste storehouse has been isolation and storehouse on the face or near face. For longer time deep geological depository is a favored result of high- position waste, while exercise and vacillation are favored results for reducing the HLW force. rudiments may be present in both useful and worrisome isotopes, which would bear expensive and energy ferocious isotope separation for their use a presently uneconomic prospect. The trefoil symbol is used to ionizing radiation. The check was conducted to check the knowledge of the dentists towards radioactive waste and how it's managed.

MATERIAL AND METHOD:

A study was conducted among the Dental Students, Practioner dentists, in the State of Maharashtra, India. A self-administered, close ended, structured questionnaire, comprising of 31 questions were designed to evaluate and assess the participant's knowledge, attitude and practice of knowledge of Radioactive waste management and its disposal. The reliability statistics of the questionnaire was checked and calculated and the Cronbach-value was 0.92, which shows that the reliability of the questionnaire was good. statistical analysis was done using descriptive analysis. A questionnaire study was conducted among the general population, in the State of Maharashtra, India with the aim to assess the knowledge and attitude of the management of radioactive waste management. A total of 250 participants (i.e., dental participants) were selected randomly. The questionnaire was designed using Google form (Google LLC, Mount view, California, USA) and a link was distributed among the study population via email, WhatsApp and other social media platforms (Instagram, Facebook). A brief introduction about the study was given to all the participants. A convenient sampling technique was used to collect the study participants. A structured, self-administered, close ended questionnaire was pre-tested and validated amongst 20 subjects to assess their knowledge, clarity and responsiveness.

The questionnaire was designed to collect data and consisted of demographic details and 3 different sections comprising 31 questions regarding knowledge(section), attitude (section) and practice (section 3). The reliability statistics where calculated and Cronbach value was 0.92. Data collected was entered in a spreadsheet (Microsoft Excel Sheet, 2016) the statistical analysis was done using descriptive statistics. The input parameter for sample size calculation used were as follows: effect size and degree of power of study, freedom. Terror 0.92, he calculated sample size calculation was using software version. The final considered sample size used in this study was 250.

Result:

A total of 250 participants were given a questionnaire through google form via email and WhatsApp having a response rate of 100%.

Table 1 shows demographic details of all the study participants. The participants were divided into age group as 18-25 yrs old, 26-40 yrs old, and above 40 yrs old. Maximum participants belonged to the age group of 18-25 yrs (74%). Out of total 250 participants 65.2% were females, and 34.8% were males. Among study population 21.2% were UG BDS students, 52.8% were Interns and BDS practitioners and 26% were PG MDS students and MDS.

Table 1 : Demographic details

Age group	Number (N)	Percentage
18-25 yrs	185	74%
26-40 yrs	62	24.8%
Above 40 yrs	3	1.2%
Sex	Number (N)	Percentage
Female	163	65.2%
Male	87	34.8%
Occupation	Number (N)	Percentage
UG BDS students	53	21.2%
Interns and BDS practitioner	132	52.8%
PG MDS students and MDS	65	26%

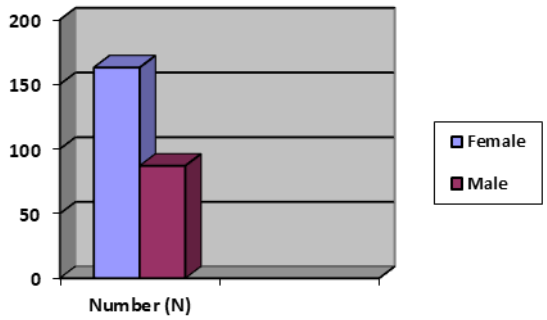

Figure 1 : Gender Distribution of study population

Table 2 shows that among the study population 75.6% believes that deep geological burials are the correct way of radioactive waste disposal, 19.2% thinks shallow burials to be the best way, 3.2% population feels composting, can be used as a method for radioactive waste disposal. Around 83.6% of population prefers that radioactive waste takes around 50 yrs for disposal, followed by 4%, 6.8% and 5.6% for 10 years, 1 year and 1 week of duration respectively.

Table 2: Correct method of radioactive waste and time required for proper disposal

Statement	Responses	Number [percentage]
Correct way of radioactive waste disposal	Deep geological burials	189[75.6%]
	Shallow burials	48[19.2%]
	Landfill	5[2%]
	Composting	8[3.2%]
Time required for proper disposal of radioactive waste	50 yrs	209[83.6%]
	10 yrs	10[4%]
	1 year	17[6.8%]
	1 week	14[5.6%]

Table 3 shows that approximately 76% of study population consider the lead packet of X-ray film to be more harmful, 18% of population believes silver, 3.2% population consider radiographic film followed by 2.8% population considering film packet. Around 81.2% of population consider 60% of lead content is harmful for body followed by 40%, 305 and 10% of lead content in opinion of 7.6%, 6.8% and 4.4% of study population respectively.

Table 3: Most harmful radioactive substance and percentage of lead content harmful for body

Statement	*Responses*	*Number [percentage]*
Most harmful radioactive substance	Lead packet	190[76%]
	Silver	45[18%]
	Radiographic film	8[3.2%]
	Film packet	7[2.8%]
Lead content harmful for body	60%	203[81.2%]
	40%	19[7.6%]
	30%	17[6.8%]
	10%	11[4.4%]

Table 4 shows that approximately 53.6% of population strongly agrees that the radioactive wastes should be discarded in different bins for proper disposal. Around 48% of the study population which participated in this questionnaire study believes that after following each and every radiation safety protocol, the radiographic exposure will be reduced.

Table 4: Assessment of disposal of radioactive waste in different bins and safety protocol for radiographic exposure

Table 4.1 *Table 4.2*

Statement 1	(%)	Responses	(%)	Statement 2
Radioactive waste should be discarded in different bins	53.6%	Strongly agree	48%	Radiographic exposure will be reduced after following each and every radiation safety protocol.
	36%	Agree	34.8%	
	5.2%	Neutral	14.8%	
	2%	Disagree	0.8%	
	3.2%	Strongly disagree	1.6%	

Table 5 shows that among participated population only 26% always practice use of devices for measuring radiation exposure and 44 %of population practice use of devices often. Around 36.4% population many a time practice the replacement of devices used for measuring radiation exposure and around 37.6% population hardly ever do replacement of devices.

Table 5: Assessment of practicing use of devices for measuring radiation exposure and replacement of these devices by every 3 months.

Table 5

Statement	Responses	N - number [%]
Use of devices for measuring radiation exposure	Always	65(26%)
	Often	110(44%)
Replacement of devices by every 3 months	Frequent replacement of devices	91(36.4%)
	Rare replacement of devices	94(37.6%)

Discussion:

The present study aims on determining operation of radioactive waste in the study population which includes scholars, graduates and postgraduates in dental practice. This study handed an important sapience into the proper system of Radioactive waste disposal in dental practice. In present study 53.6% population were apprehensive that there should be different bins for different radioactive waste which is relatively analogous to the study conducted by Mohit et al(2016) in which 86% interpreters were apprehensive of the different bins(2). There are several procedures for general waste disposal as, recycling, composting, tips, biogas generation incineration, waste contraction and deep geological burial. "According to World Nuclear Organization" Deep geological disposal is extensively agreed to be the stylish result for final disposal of the most radioactive waste produced. (5) In our study 75.6% of the population believes that the Deep geological burial is the correct way for radioactive waste disposal at the same time it's further provident. Utmost of the dental hospitals that give conventional imaging installations they use –X-ray machines, x-ray film, film developing results. Among all those, lead packet has the major impact on the terrain compared to other dental radiographic waste. In study conducted by Mohit et al(2016) 42% of the dental interpreters inclined supereminent foils and X-ray flicks independently in red/ blue color rendering holders and also discard it safely while 22% of them disposed it directly into the common caddy which isn't considered a safe system for disposal as it can affect neurological development and function as bandied by Hedge et al.(2007).(2).

According to our study 76% of the population believes that the lead packets more dangerous. The lead content of this antipode is between 69% and 85%. There's no safe position of lead exposure, it's poisonous indeed in low boluses. Lead content in the antipode can be percolated from the tips if there's no leachate collection system in place. During the anaerobic acid sub-phase of declination process, microorganisms break down accoutrements producing acids similar as acetic acid due to which there's drop in pH. This acidic pH causes significant dissolution of lead from antipode within 17 hours (5) therefore, lead enters the ecosystem. "According to US Centre for Disease Control and Prevention" and The World Health Organization, a blood lead position of 10 µg/ dl or over is a beget for concern.(2) In our study 81.27% of the population states 60% of lead content is dangerous for the body. Lead poisoning in grown-ups can affect the supplemental & central nervous system, reproductive system, blood pressure and the feathers.

Children are more sensitive than grown-ups as their gut absorbing exertion is more readily than the grown-ups. (1) Reducing terrain lead impurity by dentists is an easy and affordable task. The lead antipode from the film packet can be collected independently and returned back to the manufacturer for recycling. It appears that there's a lack of mindfulness among the dentist about this service handed by the manufacturing companies. As manufacturing companies report only about 5 of products vended are returned. (6) Radioactive wastes are stored so as to avoid any chance of radiation exposure to people, or any population. The radioactivity of the wastes decays with time, furnishing a strong incitement to store high- position waste for about 50 times before disposal. Disposal of low- position waste is straightforward and can be accepted safely nearly anywhere. (5) According to the present study 83.6% of the population believes that the radioactive waste takes around 50 times to decay. In conventional imaging there's frequent use of chemical results like inventor, fixer and outfit cleanser. Each of these results requires special running and a unique disposal procedure. In the present study 90.4% considers that these results should be disposed of through chemical treatment plans. (6) About 87.6% of the study population believes that the result should be discarded after every 3 to 4 weeks, as it may be dangerous latterly due to the presence of high situations of tableware ions.

Still, there were still 46.21% of the population who practices these styles in dental hospitals. In other study conducted by Firdous et al(2018) 38% clinicians dispose the result offsite, considering it as a dangerous waste, whereas 32% and 17% dispose in sewage and soil, independently. Only 13% store and don't dispose the used inventor.(1) When it comes to ionizing radiation, a radiation protection protocol should be rehearsed for the workers.

Use of lead aprons can shield first askers from nascence and beta patches but won't cover from gamma shafts, so the lead hedge/ partition is desirable. In other study conducted by Firdous et al(2018) 76% dentists use supereminent aprons and only 41% dispose it for reclaim.(1) In our study 48% of the population believes that the following each and every radiation safety protocol, reduces the radiographic exposure and about 40.81% of the population actually follows the 6-feet position- distance rule, which shows that there is still incognizance and negligence towards the health hazards of ionizing radiation among dental interpreters. Radiation dosimeters are bias used to measure the quantum of external radiation cure entered by individualities, and are generally assigned to an individual to record only their radiation cure. In our study the participants who rehearsed the use of radiation measuring bias are only 26% and about 24% of the participants practice renewal of the cure calibrator every 3 months. The outgrowth of our study is concentrated on radioactive waste operation that needs to be organized.

Although dental centers are considered as a minor source of healthcare waste, but they induce a certain quantum of dangerous waste. introductory knowledge regarding waste collection, isolation, and disposal could conceivably change the approach of dentists toward it. Indeed, the clinicians need to take action to enquire and acquaint themselves with correct knowledge and change the perspective.

Conclusion

Dentists have a moral and professional obligation to watch for their cases' oral health as well as their overall good. The assessment of the environmental impact of the potentially dangerous waste products from dental treatments should go beyond the radiation safety practices frequently used in dental services. The preferable approach is to switch to digital X-ray systems, which use computer- grounded bias to replace film- grounded technology and record radiographic images in digital format using electronic or storehouse phosphor receptors. The wastes produced by traditional film processing are excluded, and there are multitudinous other benefits like reduced time and image manipulation.

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