

A survey on knowledge, attitude, and practices of workplace radiation safety amongst anaesthesiology personnel in northern Indian tertiary care institutes

Address for correspondence:

Dr. Ashish Kumar Kannaujia,
Department of
Anaesthesiology, Sanjay
Gandhi Post Graduate Institute
of Medical Sciences
Rae Bareilly Road, Lucknow,
Uttar Pradesh - 226 014, India.
E-mail: ashishkannaujia77@
gmail.com

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Rudrashish Haldar, Rafat Shamim, Himel Mondal¹, Ashish Kumar Kannaujia, Prabhakar Mishra², Anil Agarwal

Departments of Anaesthesiology and ²Biostatistics and Health Informatics, Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow, Uttar Pradesh, ¹Department of Physiology, Shantiniketan Medical College, West Bengal, India

ABSTRACT

Background and Aims: Exposure to ionising radiation to Anaesthesiology consultants, residents, technicians and nurses (Anaesthesiology personnel) is steadily increasing as a consequence of growing usage of imaging technology for diagnostic and therapeutic purposes. We conducted a questionnaire-based survey of Anaesthesiology professionals (consultants, residents, technicians and nursing staff) working in three major tertiary care medical institutes in northern India regarding the existing knowledge, attitudes and practices of radiation safety at their workplaces.

Methods: A printed and validated 30-point questionnaire was distributed. Questions were graded into the domains of demographics (6 questions), knowledge (9 questions), attitude (4 questions) and practice (11 questions). Data obtained from the responses was collated and analysed statistically

Results: Out of the 403 questionnaires distributed, 222 were returned completed (55%). Majority of the respondents were residents (53.60%) and males (57.20%). Many were unaware of the principle of As Low As Reasonably Achievable (ALARA), (70.7%) regarding collimators (65.85%) and their usage (41.9%). Maximum respondents stressed on the necessity of knowing the exposure dosage of radiations (89.2%) and were concerned regarding the same (87.8%). Lead apron was the commonest protection equipment and 97.3% of them were not using dosimeters. Highest levels of knowledge, attitude, and practices were demonstrated by the consultants. In terms of practices, the technicians fared better than the residents. **Conclusion:** Knowledge, attitude and practices regarding radiation protection issues and doses of radiological procedures is limited. Although all the cadres scored high on their attitude scores, the practice sector requires improvement.

Key words: Anaesthesiology, radiation, radiation dosimeters, radiation exposure, radiation protection

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INTRODUCTION

A phenomenal increase has been witnessed in the periprocedural use of imaging techniques in operation theatres (OTs), interventional suites and intensive care units (ICUs) in the past few years. These are the zones where the Anaesthesiology consultants, residents, technicians, and nursing staff form the bulk of the workforce. Consequent to delivering anaesthesia services and quality patient care, they are exposed to significant doses of radiation. Ionising radiations are proven carcinogens,^[1] and it has been observed that the knowledge medical professionals possess regarding

them is inadequate regardless of their specialisation.^[2,3] Increasing usage of medical radiation with inaccurate

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and inadequate knowledge about radiation protection and dosages results in significant health risks.^[4,5]

Previous studies reveal high radiation exposures to anaesthesiologists.^[6-8] However, the Anaesthesiology residents, technicians, and nursing staff who form the bulk of the workforce delivering anaesthesia services often do not find mention in these studies. It is important to assimilate their inputs to design future education and training strategies to increase the safety standards. Moreover, majority of the studies are from western countries and there is paucity of Indian data.

With these reasons in the background, we conducted a questionnaire-based survey^[9] amongst Anaesthesiology consultants, residents, technicians, and nursing staff working in tertiary care medical institutes regarding their existing knowledge, attitudes, and practices of workplace radiation safety. Based on the findings obtained, we expect to delineate areas of concern regarding occupational radiation safety and suggest measures to improve the same.

METHODS

This prospective cross-sectional survey was conducted in three apex tertiary care centres of Lucknow, Uttar Pradesh, India - Sanjay Gandhi Post Graduate Institute of Medical Sciences, Ram Manohar Lohia Institute of Medical Sciences, and King Georges Medical College. The survey was conducted from 23 April 2020 to 14 May 2020. The study was approved by the institute ethics committee (2020-10- EXP-14) and was registered with the Clinical Trials Registry - India [CTRI/2020/04/024791 (Registered on: 22 April 2020)]. Survey response was obtained after taking written consent from adult participants (age >18 years).

Anaesthesiology consultants, residents, technicians, and staff nurses who were conversant in English were recruited from the three institutions. Henceforth in the manuscript, they are collectively referred to as Anaesthesiology personnel (AP). A total of 403 AP were working in these institutions and we distributed the survey questionnaire among them.

As there was no pre-existing questionnaire in the literature, we designed^[9] a 30 point self-administered, anonymous questionnaire in English based on relevant bibliographic references and experiences of the authors [Appendix 1]. Each question offered three to

five possible answers. The first part of the questionnaire collected data about demographics (viz., age, gender, designation, duration of work, type, and location of practice). Then, the questions were classified into three different domains - knowledge (nine questions), attitudes (four questions), and practices (eleven questions). Content validity of the questionnaire was analysed by the seven representatives who rated each question based on simplicity, clarity, ambiguity, and relevance of each question. Percentage overall agreement of each question was calculated. Overall agreement of 88.06% for simplicity, 85.10% for clarity, 88.71% for ambiguity, and 84.84% for relevance was found. This level indicates a good agreement. The representatives' comments were used to modify the questionnaire further. Thereafter, a pilot study was conducted amongst 10 AP to establish the reliability of the scale. Two sets of responses (with a two-week time interval) were used for establishing test-retest reliability via estimating the Pearson correlation coefficient, showing the acceptable reliability of the scale. Questionnaire's reliability was assessed as internal consistency using Cronbach's alpha coefficient.

Printed questionnaire was distributed amongst the AP with a request to voluntarily and anonymously self-record their responses. A time period of one week was given to the respondents to complete the questionnaire and return it. After one week, a reminder was sent to the AP and another week was given for questionnaire completion. After the second week, those who did not return the questionnaire were marked as non-respondents. Returned questionnaires were then screened for completeness of responses and partially filled questionnaires were omitted from final analysis.

Data were coded on Microsoft Excel 2010® (Microsoft) and stored for further analysis. Data were presented in number, percentage, mean, and standard deviation and statistically tested by Binomial test and Chi-square test. Statistical tests were carried out using GraphPad Prism 7 (GraphPad Software, Inc.). A value of $P < 0.05$ was considered as statistically significant.

RESULTS

A total of 403 printed questionnaires were distributed, out of which 222 completed forms were returned. Thus, the survey response rate was 55.09%.

The sociodemographic parameters (6 questions) revealed that maximum respondents belonged to the age group of 18-30 years (43.24%), were residents (53.60%), of male gender (57.20%), had spent 1-5 years in clinical Anaesthesiology (45.05%) and were usually exposed to radiations 2-5 times/week (38.29%). Among the respondents, 31.08% were posted in the OTs, ICUs as well as peripheral locations like intervention suites [Table 1].

Nine questions were administered to assess the knowledge levels. Nearly one-third (38.7%) of the responses marked that radiology technicians were conducting fluoroscopic examinations in their work zones. A bulk of them neither had previous training in operating fluoroscopy (95.5%) nor had training in radiation safety (89.2%). A sizeable number of participants were aware of the use of dosimeter (65.8%) and regarding dose optimisation strategies (62.2%). However, a bulk of the respondents (70.7%) were unaware of the principle of As Low As Reasonably Achievable (ALARA), regarding collimators (65.85%) and their usage (41.9%). About 30.2% of the

participants believed that the C- arm had the X ray tube at the bottom [Table 2].

In terms of their attitude, (4 questions), 64% of the participants believed that their knowledge level regarding radiation was insufficient and that the medical radiologist is the appropriate person to provide information regarding ionising procedures (79.3%). Maximum respondents were unanimous about the necessity of knowing the exposure dosage of ionising radiations during procedures (89.2%) and were concerned regarding the same (87.8%) [Table 3].

With regards to their daily practices (11 questions), 87.8% of the AP confirmed the availability of radiation protection equipment (RPE) in their workplaces of which the lead apron was the commonest available (65.77%). Majority of them (60.8%) were unaware whether the RPE were sent for routine checking or not. Bulk of the respondents (97.3%) were not using dosimeters and 80.6% of them were unaware regarding the practice of sending the dosimeters for measurements [Table 4].

When the domains of knowledge, attitude and practices were analysed individually in the different cadres (consultants, residents, nurses and technicians) of AP, it was observed that the highest levels of knowledge, attitude, and practices were demonstrated by the consultants. In terms of practices, the technicians fared better than the residents [Table 5, Figure 1].

DISCUSSION

The importance of workplace radiation safety cannot be overemphasised especially when radiation usage has made widespread inroads in the workplaces of AP, exposing them to radiation on a daily basis. Thus, the study aimed to analyse the levels of knowledge, attitude and practices regarding radiation safety amongst AP in the three apex medical institutes of Lucknow.

Measuring previous knowledge is an important tool for further educational activities and our research found a considerable heterogeneity in the knowledge of radiation hazards and their prevention. Increased distance from the fluoroscopy units, use of low dosage and appropriate shielding are conventional modalities to reduce radiation exposure.^[9-11] The results obtained from the study showed that a sizeable proportion

Table 1: Sociodemographic distribution of the Anaesthesiology personnel surveyed

Parameters	Response category	Number (percentage)	χ^2, P
Age	18-30 years	96 (43.24)	91.41, <0.0001
	30-40 years	85 (38.29)	
	40-50 years	28 (12.61)	
	>50 years	13 (5.86)	
Designation	Consultants	35 (15.77)	97.78, <0.0001
	Residents	119 (53.60)	
	Technicians	39 (17.57)	
	Nurses	29 (13.06)	
Gender	Male	127 (57.20)	0.04*
	Female	95 (42.8)	
Years spent in clinical Anaesthesiology	<1 year	41 (18.47)	90.39, <0.0001
	1-5 years	100 (45.05)	
	5-10 years	27 (12.16)	
	>15 years	26 (11.71)	
Zones of working	OTs	82 (36.94)	83.09, <0.0001
	ICU	34 (15.32)	
	OTs + ICU	29 (13.06)	
	OTs + Peripheral Calls	8 (3.60)	
	OTs + ICU + Peripheral calls	69 (31.08)	
	Never	4 (1.81)	
Exposure frequency	<1/week	50 (22.52)	124.6, <0.0001
	1/week	50 (22.52)	
	2-5/week	85 (38.29)	
	6-10/week	12 (5.40)	
	>10 week	21 (9.46)	
	Never	4 (1.81)	

*P value of Binomial test OT: Operation theatre, ICU: Intensive care unit

Table 2: Knowledge related to radiation safety in Anaesthesiology personnel			
Questions	Response category	Number (percentage)	χ^2, P
Person operating fluoroscopy	Another doctor	21 (9.5)	230.5, <0.0001
	OT Staff	77 (34.7)	
	OT Staff and another doctor	4 (1.8)	
	Radiology technician	86 (38.7)	
	Radiology technician and another doctor	2 (0.9)	
	Radiology Technician and OT staff	21 (9.5)	
	Radiology Technician and OT staff and another doctor	11 (5)	
Previous training in operating fluoroscopy	Yes	10 (4.5)	<0.0001*
	No	212 (95.5)	
Previous training in radiation safety	Yes	24 (10.8)	<0.0001*
	No	198 (89.2)	
Knowledge regarding dosimeter	Yes	146 (65.8)	<0.0001*
	No	76 (34.2)	
Knowledge regarding ALARA	Yes	65 (29.3)	<0.0001*
	No	157 (70.7)	
Knowledge regarding dose optimisation	X-ray examinations should be prescribed and carried out only when they are really necessary.	28 (12.6)	171.6, <0.0001
	The dose delivered by an X-ray examination must be kept as low as reasonably achievable and compatible with the attainment of the required diagnostic information	43 (19.4)	
	An X-ray examination must include the widest anatomical area, so that a single exposition can give the maximum diagnostic information	13 (5.9)	
	All previous answers are correct	138 (62.2)	
Knowledge regarding position of C-arm	X-ray receiver at the bottom	49 (22.1)	59.26, <0.0001
	X-ray receiver at the top	1 (0.5)	
	X-ray tube at the bottom	67 (30.2)	
	I don't know	59 (26.6)	
	Have never noticed	46 (20.7)	
Knowledge and availability of collimator	Aware and available	41 (18.4)	105.3, <0.0001
	Aware and unavailable	35 (15.8)	
	Unaware	146 (65.8)	
Knowledge regarding usage of collimator	At all times	9 (4.1)	158.7, <0.0001
	Most of the time	7 (3.2)	
	Only in specific conditions	27 (12.2)	
	Never	86 (38.7)	
	No response	93 (41.9)	

*P value of Binomial test. ALARA: As low as reasonably achievable, OT: Operation theatre

Table 3: Attitude regarding ionising radiation safety at workplace in Anaesthesiology personnel			
Questions	Response category	Number (percentage)	χ^2, P
Rating of individuals' knowledge regarding ionising radiations	Excellent	9 (4.1)	291.9, <0.0001
	Good	13 (5.9)	
	Sufficient	48 (21.6)	
	Insufficient	142 (64)	
	No knowledge	10 (4.5)	
Appropriate person to provide information regarding ionising radiations	Family physician	2 (0.9)	222.8, <0.0001
	Medical physicist	44 (19.8)	
	Medical radiologist	176 (79.3)	
	Any other (please specify)	0	
Necessity of information regarding radiation dosages during procedures	Yes	198 (89.2)	<0.0001*
	No	24 (10.8)	
Concern regarding radiation exposure	Yes	195 (87.8)	<0.0001*
	No	27 (12.2)	

*P value of Binomial test

of the APs lacked training in operating fluoroscopy equipment and in radiation safety. The knowledge

regarding ALARA was glaringly lacking as was their familiarity with the concept of dose optimisation. In

Table 4: Practices related to ionising radiation safety at workplace in Anaesthesiology personnel

Questions	Response category	Number (percentage)	χ^2, P
Provision of Radiation Protection Equipment (RPE)	Yes	195 (87.8)	299.8, <0.0001
	No	24 (10.8)	
	Unaware	3 (1.4)	
Types of RPE used	Lead Apron	146 (65.77)	
	Lead Apron + RP glasses	6 (2.70)	
	Lead Apron + Thyroid Shield	40 (18.02)	
	Lead Apron + Thyroid Shield + RP glasses	2 (0.9)	
	Do not use them	28 (12.61)	
Practice of subjecting the RPE to regular checking	Yes	8 (3.6)	109.5, <0.0001
	No	79 (35.6)	
	Unaware	135 (60.8)	
Practice of using dosimeter	Yes	6 (2.7)	<0.0001*
	No	216 (97.3)	
Practice of sending the dosimeter for regular measurements	Yes	9 (4.1)	227.7, <0.0001
	No	34 (15.3)	
	I don't know	179 (80.6)	
Provision of audible or visible signs during use of ionising radiations	Yes	72 (25.7)	8.84, 0.012
	No	93 (32.4)	
	I don't know	57 (41.9)	
Distance maintained by anaesthesiology professional from the radiation emitting device	1-2 steps	43 (19.4)	137.4, <0.0001
	3 metres	103 (46.4)	
	As far as possible	1 (0.4)	
	Have not noticed	56 (25.2)	
	I don't care	19 (8.6)	
Position of the anaesthesiology professionals during shooting	Towards the tube	15 (6.8)	92.19, <0.0001
	Towards the receiver	20 (9.0)	
	Far away	80 (36.0)	
	I don't know	29 (13.1)	
	I don't care	78 (35.1)	
Searched for information regarding ionising radiations	Yes	124 (55.9)	0.09*
	No	98 (44.1)	
Presence of dose limiting software	Yes	39 (17.6)	163.0, <0.0001
	No	20 (9.0%)	
	Unaware	163 (73.4)	
Existence of policies which reduce radiation exposure to anaesthesiology professionals	Yes	45 (20.3)	43.86, <0.0001
	No	57 (25.6)	
	Unaware	120 (54.1)	

*P value of Binomial test

Table 5: Cadre-wise analysis of the domains

Domain	Category	Number	Mean	Standard Deviation	Standard Error
Knowledge	Consultant	35	59.8367	17.17005	2.90227
	Residents	119	45.3541	15.40216	1.41191
	Technicians	38	44.9624	15.46034	2.50800
	Nurses	29	41.2808	11.72041	2.17643
	Total	221	47.0459	16.22316	1.09129
Attitude	Consultant	35	83.5714	6.01119	1.01608
	Residents	119	79.0756	8.18138	0.74999
	Technicians	39	70.5128	17.68864	2.83245
	Nurses	29	79.3103	13.07425	2.42783
	Total	222	78.3108	11.50281	0.77202
Practice	Consultant	35	50.1714	15.53267	2.62550
	Residents	117	41.9487	10.51259	0.97189
	Technicians	38	49.2632	10.88933	1.76648
	Nurses	29	36.5517	10.67569	1.98243
	Total	219	43.8174	12.31853	0.83241

the absence of appropriate awareness of the radiation protection, APs may be unintentionally exposed to increased radiation doses. Therefore, previous studies have emphasised the necessity of prior radiation safety training.^[7,12] Previous researches evaluating radiation safety education had demonstrated that formal training in the use of these machines and safety training programmes created greater awareness regarding radiation safety.^[13,14] The anterior-posterior orientation of the C- Arm is important as an X-ray tube positioned on top of the table produces ten times higher radiation exposure than those positioned below. Because of this, the X-ray tube is usually positioned underneath the patient. A sizeable number of respondents (47.3%) were unaware or did not care about the position of the C-Arm when it is being used. Collimation, alters

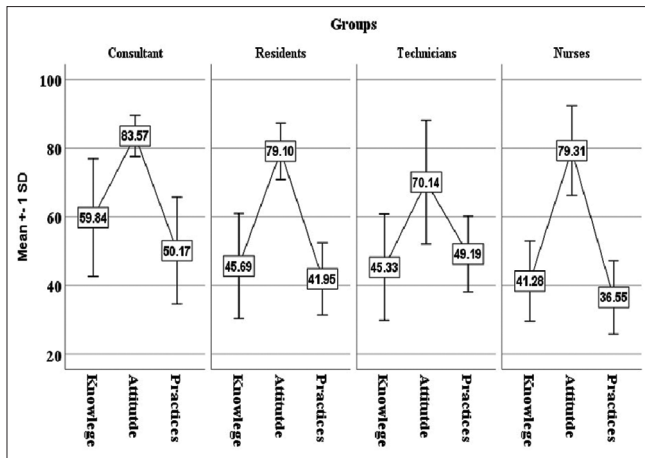


Figure 1: Knowledge, Attitude, and Practices levels in percentages amongst different cadres of Anaesthesiology personnel

and selectively decreases the generated radiation and improves image quality.^[15] A vast majority of the respondents were either unaware (65.8%) of the availability or did not respond when they were asked regarding its usage.

Maximum participants of our survey (64%) rated their knowledge regarding ionising radiations as insufficient. Likewise, the deficiency of awareness and knowledge of medical professionals regarding their understanding of ionising radiation or the use of the equipment involved has been previously highlighted.^[4,16] A large proportion of AP (89.2%) in the current survey, believed that it was necessary to know the radiation dosage which is attributed to a particular procedure while they were involved in it. It has been previously observed that medical professionals tend to underestimate the radiation dosages to which they are exposed thereby unnecessarily increasing their exposure.^[17] Dagal had previously reinforced the need to document the doses for all personnel who are occupationally exposed.^[12] Knowledge and practice pertaining to radiation exposure is expected to be highest amongst medical radiologists as they are considered to be experts in this territory.^[17] A vast majority (87.8%) of the respondents were concerned about the radiation exposure received by them while they were involved in their practice. A previous American study also showed that irrespective of gender, anaesthesiologists were concerned with radiation, albeit females were more so.^[18] Though we did not analyse the gender difference, our findings were consistent with the previous study.

For radiation protection, the most efficient method is the use of lead-containing body armour (protective

leaded aprons and thyroid shields); nevertheless, RPE availability was confirmed by a sizeable proportion of our respondents.^[19] Amongst them, lead apron was the commonest RPE used by 65.77% of the participants. Previous studies have reported the usage of lead apron ranging from 30%-75% amongst various medical professionals.^[8,20,21] Lead aprons as well as thyroid shields must be inspected periodically (annually) for damage and cracks from improper folding or storage.^[22] Aprons should be stored on hangers with minimal folds and their integrity monitored annually with fluoroscopy. Though intact lead aprons, thyroid shields and glasses are recommended to be worn,^[23] majority of the respondents (60.8%) in our survey were unaware whether their RPE were subjected to regular checking or not. Personal dosimeters have been recommended to be worn by anaesthetists who routinely undertake interventional neuroradiology and endovascular aneurysm repair (EVAR) lists.^[23] Hardly 2.7% of the respondents in our study wore dosimeters which was similar to the figures quoted for Turkish anaesthesiologists.^[6] Dosimeters are required to be sent to authorised centres for measurement. In our survey, 80.6% of the respondents were unaware regarding the practice of sending the dosimeters for measurement. Audible and visual alarms can pre-empt the APs for taking evasive actions like wearing RPEs, going behind barriers or increasing the distance from the radiation-emitting source etc. These alarms were absent as reported by 32.4% of the respondents and 41.9% of the respondents were unaware regarding the presence of the alarms. Doubling the distance from the patient reduces the exposure by a factor of four. A survey in Trinidad showed that approximately two-thirds of the participants were unaware of the appropriate safe distance to reduce radiation exposure.^[14] Majority of our respondents (46.4%) were correctly of the opinion that they should be standing at a distance of 3 m away from the radiation source. Standing on the same side of the table as the radiograph tube for the horizontal beam exposes the anaesthesiologist to more scatter radiation than the radiologist, who is working from the side of the image intensifier.^[24] In our survey, although 36% of the participants reported positioning themselves far away from the source of radiation, what is worrisome is that 13.1% of them did not know about where they are positioned with respect to the radiation source and 35.1% did not care about it altogether. Thus, a gaping difference in the practice of positioning exists. A significant number of the participants are concerned while dealing with ionising radiation which

was evident as a majority of the participants (55.9%) admitted to have searched for information regarding ionising radiations. Wang *et al.* in their project also observed that 94% of Anaesthesiology residents showed interest in educational materials on radiation safety.^[23] Most modern systems have an algorithm that allows magnification without additional radiation, limits the fluoroscopy beam time, allows radiation limited fluoroscopy beam time, pulse mode fluoroscopy, last image hold and avoids continuous fluoroscopy. Majority (73.4%) of the participants were unaware regarding the presence of such software. Optimised radiation protocols, ensuring appropriate use of the modality to tailor examinations and minimising radiation for AP and patients should be the responsibility of the institute. Radiation use for diagnostic and therapeutic purposes requires impeccable justification and once justified, exposure should be as low as is practicable. AP have a responsibility in enforcing the same in both these areas.^[26] In our study, 54.1% of the respondents were unaware regarding the existence of radiation protection policies in their institutes.

When the different domains were analysed individually for the different categories of AP, it was seen that consultants fared best in the knowledge (59.84%), attitude (83.57%) and practice (50.17%) domain. The nursing staff had the lowest scores in terms of knowledge (41.28%) and practices (36.5%). The nursing cadre scored high on their attitude aspect (79.31%).

The strength of the study is that it is the first of its kind which amalgamated AP of different categories (consultants, residents, technicians and nurses) and recorded their responses. The study also has several limitations. First, the survey was conducted in a single city, so our sample refers to a localised specific population. Questionnaire-based studies are susceptible to biases such as acquiescence (Yeh-saying) bias, deviation (faking bad) bias, and social desirability (faking good) bias. Besides that, with a self-reported questionnaire, some participants exaggerate their knowledge and the element of guesswork introduces further bias. We suggest larger nationwide studies on the awareness about protection against radiation which will provide further insights.

CONCLUSION

The knowledge, attitude, and practices of radiation protective measures by AP have not reached the

desired levels of safety. A higher degree of proficiency is expected from the different categories of AP. Thus, continuous teaching, regular radiation safety trainings, repeated reinforcement and improvement in attitudes of AP are crucial to the development of safe operating practices in a radiation environment and to improve the radiation safety culture.

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Conflicts of interest

There are no conflicts of interest.

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APPENDIX 1

Questionnaire Regarding Workplace Radiation Safety

Instructions and general comments regarding the survey

Thank you for choosing to participate in this survey. The survey aims to collect information regarding radiation safety in your area of work by analysing the knowledge and practices about radiation safety amongst Anaesthesiology personnel. The procedure of conducting the survey and the questionnaire to be used in the same has been approved by the Institute Ethics Committee (IEC) of SGPGIMS vide IEC Code 2020-10 -IP-EX -14 dated 12th January 2020.

It is important that you remain honest and open in your answers. The accuracy and completeness of your answers will be invaluable for us to get a true picture regarding where we stand as of today

General comments:

The following should be considered prior to taking the survey

- Your participation is entirely voluntary and you can wish to refuse answer any of the following questions
- Your responses will be kept strictly confidential and will not be shared and your identity will not be divulged

Q1) What is your designation?

- a) Consultant b) Resident c) Others (specify)

Q2) Gender

- a) Male b) Female c) Any other

Q3) Age Group

- a) 18-30 years b) 30-40 years c) 40-50 years d) 50 years and above

Q4) Number of years involved in stream of anaesthesiology and/or critical care

- a) Less than 1 year, b) 1 to 5 years c) 5 to 10 years d) 10 to 15 years e) more than 15 years

Q5) Zone of work

- a) Operation Theatre b) Intensive Care Unit c) Peripheral locations like Interventional Gastroenterology Units, heart catheterisation laboratories, radiotherapy suites d) others (specify)

Q6) On an average, how often are you exposed to fluoroscopic/CT radiation (X Rays)?

- a) Never b) Less than once a week c) Once a week c) 2 to 5 times a week c) 6 to 10 times a week d) More than 10 times per week

Q7) Who uses the fluoroscopy at your work place?

- a) Radiology technicians b) Operating room staff c) Another doctor d) Any other personal (please specify)

Q8) Have you been trained to use fluoroscopy?

- a) Yes b) No

Q9) Are you worried about radiation exposure from Fluoroscopy/CT radiations (Xray) at your workplace?

- a) Yes b) No

Q10) Have you been trained for radiation safety?

a) Yes b) No c) Offered but did not undergo training (specify reasons)

Q11) Is there a provision for radiation protective equipment at your place if you are attending to a case where fluoroscopy/CT scanning is taking place?

a) Yes b) No c) Unaware

Q12) If the answer to previous question is “Yes”, then which protective equipment (can choose multiple options) do you use?

a) Lead apron b) Radio-Protective glasses c) Radio-protective gloves d) Thyroid Gland Shields
e) Do not use them

Q13) Are your protective equipment subjected to periodic checking?

a) Yes b) No c) I Don't know

Q14) Do you know what is a dosimeter (radiation measuring badge)?

a) Yes b) No.

Q15) Do you use a dosimeter?

a) Yes b) No

Q16) If you are using a dosimeter, is it routinely sent for measurements?

a) Yes b) No c) I don't know

Q17) Are there any visible/audible alarms or signs or other forms of notifications before the fluoroscopic equipment are used?

a) Yes b) No c) I don't know

Q18) How far away from the device do you usually stay during fluoroscopy shots?

a) 1 to 2 steps b) At least 3 m c) I do not care d) Have not noticed how far I stay

Q19) At which position does the C-arm device stand during shooting?

a) The x-ray tube at the bottom, the X-ray receiver at the top b) The X-ray receiver at the bottom, the X-ray tube at the top c) I do not know d) Have never thought about it

Q20) Where do you stand during shooting?

a. Towards the x-ray tube b) Towards the X-ray receiver (detector) c) Far away d) I do not care

Q21) How do you rate your knowledge level about ionising radiation related risks

a) Excellent b) Good c) Sufficient d) Insufficient e) No knowledge

Q22) Have you ever searched for information about the risk associated with ionising radiation for medical purposes?

a) Yes b) No

Q23) Are you aware of the concept of “As Low As Reasonably Achievable” (ALARA)

a) Yes b) No

Q24) Which of the following best describes the concept of “dose optimisation” of radiations used for imaging?

a) X-rays examinations should be prescribed and carried out only when they are really necessary.

- b) The dose delivered by an X-ray examination must be kept as low as reasonably achievable and compatible with the attainment of the required diagnostic information.
- c) An X-ray examination must include the widest anatomical area, so that a single exposition can give the maximum diagnostic information.
- d) All previous answers are correct

Q25) Which of the following health care professionals do you believe to be the most suitable to provide information about risks arising from X-rays (ionising radiation)?

- a) Medical Physicist b) Family physician (General Practitioner) c) Medical Radiologist d) any other (Specify)

Q26) Do you believe it useful to have the information about the dose of X-rays (i.e. ionising radiation) absorbed during the radiological procedure prior to the procedure?

- a. Yes b) No

Q 27) Are you aware of what is a collimator and is it available at your place?

- a) Unaware b) Aware and unavailable c) Aware and available

Q28) If available then, when is the collimator used at your workplace?

- a. at all times b) most of the times sometimes c) only in specific conditions (specify) d) never

Q29) Does your place of work have policies which minimise exposure to personnel exposed to radiation?

- a) Yes b) No c) Unaware

Q30) Does your imaging equipment have dose-limiting software?

- a) Yes b) No c) Unaware