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Level of Observation of Radiation Protection Rules by Radiology Staff of Hospitals in the City of Mbujimayi

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Abstract

Purpose and Objectives: As any health study generally aims to contribute to the improvement of the state of the health of the population, this one tries to respond from a particular angle to the improvement of the health of the personnel of the health sector. Radiology by combating the risks is associated with X-rays (RX). So this study aims to help promote greater safety in the use of X-rays in hospitals in the city of Mbujimayi while highlighting the shortcomings in terms of radiation protection and the consequences that this entails. **Methodology:** Our study is descriptively cross-sectional using the prospective method, supported by the technique of direct interview. It was conducted in eight health facilities in Mbujimayi, with radiology staff, during a period from May 2 to June 6, 2021, on 10 cases. **Results:** At the end of our study, the results of the level of compliance with radiation protection rules by radiology personnel are as follows: 100% of the personnel did not receive training in radiation protection, and most of them had previously worked in other radiology departments, *i.e.*, 64.3% of cases; 100% of personnel did not wear a dosimeter while 64.3% had means of individual protection such as a led apron and 35.7% had led screens; 100% were not protected against scattered rays; radiation protection measures were weak (64.3%); 100% of personnel did not receive or benefit from control after exposure to X-rays; 100% of radiology departments did not have a warning sign indicating the dangers of X-rays. **Closing:** The use of X-rays in the hospitals in the city of Mbujimayi poses a problem, because no structure in the city of Mbujimayi respects the regulations on radiation protection and the level of observation of radiation protection measures by the radiology staff in Mbujimayi hospitals is weak.

Subject Areas

Radiology & Medical Imaging

Keywords

Level, Observation, Rules, Radiation, Protection, Staff, Hospitals, City, Mbujimayi

1. Introduction

The use of X-rays in the hospitals in the city of Mbujimayi poses a problem, because the level of observance of the rules of radiation protection by the radiology personnel of the hospitals in Mbujimayi is low.

A survey carried out on 255,321 workers monitored on the dosimetric level shows that medical personnel represents the largest proportion of the people monitored with around 36% of the total workforce, *i.e.*, 92,948 workers. Among the 92,948 people in the medical community monitored, 1% were checked above the tolerance thresholds, given the risk represented by ionizing radiation and the number of authorized thresholds exceeded [1] [2] [3].

Cohort studies of radiologists or radiologist technicians carried out in the United States, Great Britain and China have revealed an excess risk of certain cancers among exposed subjects, in particular those exposed at the beginning of the 20th century [4].

According to the report published in 1996 on occupational radiation exposures in Canada, it is above all technicians in radiation oncology, nuclear medicine and industrial radiology who are the most likely to be exposed to annual levels exceeding 2 mSv at the abdominal surface [5].

A survey carried out in 2005 on 255,321 workers monitored on the dosimetric level by the French Institute for Radio-protection and Nuclear Safety (IRSN) revealed that 36% were medical personnel and that 1.3% of them were controlled above individual tolerance thresholds of 1 mSv [6].

Individual dosimetry data were held and analyzed by the IRSN, and 143,000 people in the medical sector were monitored for exposure to ionizing radiation using passive dosimeters during the year 2004 in France. These health professionals represent nearly 60% of all people monitored by individual dosimetry. Of the total workforce of the supervised medical sector, radiology represents a preponderant share (65%), followed by the dental sector (17%). The other sectors of medical activity (radiotherapy, nuclear medicine, *in vitro* unsealed sources, occupational medicine, veterinarians) come next [7].

A study carried out in Abidjan on the observance of radiation protection rules in hospitals revealed that the administrative rules were poorly followed: 50% of establishments were not registered with the Central Service for Protection against Ionizing Radiation (CSPAIR). And 83.3% did not have people skilled in radiation protection. Concerning the technical provisions, 29.6% of the premises had no signage, 46.1% of the radiology rooms had on average 10 years of operation and 79.2% had undergone at least 3 repairs per year. Checks before commissioning and routine checks concerned 11.1% and 29.1% of installations respectively. The majority of workers (97.5%) protected themselves with a lead apron; 59.8% of them wore a dosimeter [8].

In DR Congo the law of 017/2002 stipulates in article 5 that: any practice or any activity involving exposure to ionizing radiation is subject to prior authorization. This authorization is granted only if this practice or activity complies with the following fundamental principles:

- Do not involve uncontrollable risks for the health and safety of exposed persons and the general population;
- To see the implementation of measures and precautions aimed at ensuring optimal protection of people, property and the environment;
- Be undertaken only by persons qualified to provide professional responsibility, supervision and appropriate infrastructure;
- Be likely to produce a positive net benefit, keep radiation exposure as low as reasonably achievable taking into account prevailing socio-economic factors, and limit exposure doses to levels set by regulation in force [9].

In Kasai Oriental, specifically in Mbujimayi, a study carried out in 2016 revealed that 100% of radiologist technicians in our hospitals have not received training in radiation protection adapted to the nature of the risks to which they are exposed. The same study showed that radiology technicians are unaware of the risks associated with working in radiology, and 81.0% of respondents know that they are exposed to risks in the radiology department. Among these risks, 100% of them cited risks such as: cancer (80.9%), sterility (80.9%), 57.1% mentioned leukemia and 4.8% cited blindness [10].

At this level of our research, we asked ourselves the question: what is the level of observation of the rules of radiation protection by the radiology staff of the hospitals in the city of Mbujimayi?

Our study aims to contribute to promoting greater safety in the use of X-rays in our hospitals while highlighting the shortcomings in terms of radiation protection and the consequences that this entails.

And it highlights the socio-demographic, economic and environmental factors underlying the risks associated with ionizing radiation in the city of Mbujimayi.

2. Material and Methods

This is a study descriptive cross-sectional, using the prospective method, supported by the direct interview technique; carried out in the city of Mbujimayi over a period from May 2 to June 6, 2021, among radiology personnel, *i.e.*, a total of 10 squares.

It was carried out in the eight health structures of the city of Mbujimayi (HGR Christ the King; HGR Bonzola; HGR Dipumba; SUMEDCO; KAMED; HGR StSauveur; HGR Franciscan Sisters; HGR Tudikolela) with the staff of radiology. These were recruited for convenience.

2.1. Selection Criteria

Was included in this study:

- All staff of the radiology department of these eight hospitals in the city of Mbujimayi and being present on the day of our visit for data collection; having agreed to participate voluntarily, freely and voluntarily in the study; and working regularly in the radiology unit of his hospital.

Were excluded from this study:

- Any personnel deemed mentally unfit; any personnel who have shown themselves to be unavailable; all other personnel who do not meet the criteria mentioned above.

2.2. Sampling

Our sample was obtained by the non-probability sampling technique precisely by convenience sampling, having targeted all the personnel working in the radiological units of their respective hospitals during our visits for data collection and to be included in the study.

2.3. Data Collection

This cross-sectional survey concerned personal radiology. We made the descent on the ground, in the eight health structures; we questioned 10 radiology personnel present at work who freely consented to answer. We thus proceeded with a structured interview of the face-to-face type using a pre-established questionnaire which contained closed, open and semi-open questions taking up the different variables of the study.

This data collection instrument was divided into 3 sections: section 1 presented the socio-demographic and economic characteristics of the staff of the radiology department; section 2 examined the main characteristics of the protective measures; Section 3 addressed the characteristics related to the risks of ionizing radiation. The interview took place at times and times that did not disturb the flow of work in a climate of peace depending on the days and hours of the service.

2.4. Data Analysis

The data from the surveys based on the interview grid with the staff of the radiology departments of the hospitals in the city of Mbujimayi were entered in Word and Excel 2013 and used with the Epi Info ™ 7.1.1.14 software. The results of the study are presented in the form of tables comprising the numbers observed, the proportions and the means.

3. Results

In the light of Table 1, we find that: 57.1% of the staff are over 55 years old and 42.9% are under 55 years old; the masculine sex predominates with 78.6% while the feminine has 21.4%; Radiology technicians are less numerous than other health professionals, *i.e.*, 21.4%; 100% of the personnel did not receive training in radiation protection, most of them had previously worked in other radiology departments, *i.e.*, 64.3%.

It emerges from Table 2 that 100% of the personnel do not wear the dosimeter while 64.3% have means of individual protection such as the led apron and 35.7% have led screens; 100% are not protected against scattered rays.

Table 3 reveals that the radiation protection measures are weak (64.3%), and 100% of the personnel did not receive or benefit from control after exposure to X-rays. 100% of the radiology departments do not have a control panel signage indicating the dangers of X-rays.

4. Discussion

Compliance with radiation protection measures can begin with the best knowledge of the rules by the personnel working in the radiology department. Observance of radiation protection rules by radiology personnel reassures, guides, directs, and serves as a shield against almost all the risks of ionizing radiation.

Table 1. Socio-demographic and economic characteristics of radiology service personnel.

		Frequency	%
Age	55 and over	8	57.1
	>55 years old	6	42.9
Sex	female	3	21.4
	Male	11	78.6
Staff profile	radiologist technician	3	21.4
	male nurse	5	35.7
	Administration	6	42.9
Educational level	Primary	2	14.3
	University	12	85.7
Time spent at work	5 - 12 years old	8	56
	13 - 20 years old	3	21
	21 and over	3	21
Number of exams per day	2 exams	3	21.4
	5 exams	6	42.9
	7 exams	5	35.7
Previous exposure	Yes	9	64.3
	Boop	5	35.7
Training received radiation protection	Boop	14	100
Number of hours	13 hours	8	57.1
	4 hours or more	6	42.8
Leave plan	Yes	8	57.1
	Boop	6	42.9

Table 2. Main characteristics of protective measures.

		Frequency	%
Personnel radiation protection measures	Lead Apron	11	78.6
	Lead screen	3	21.4
Knowledge and protection X-ray doses	Yes	8	57.1
	Do not know	6	42.9
Protection against scattered rays	Do not know	14	100
Protection of others professionals attending the radiology department	Yes	8	57.1
	Boop	6	42.9
Radiation protection of radiology technicians	To employ	11	78.6
	Staff	3	21.4
Individual means of protection put into service	Lead Apron	9	64.3
	Lead screen	5	35.7
Use of dosimeter	Boop	14	100

Table 3. Characteristics related to the risks of ionizing radiation.

		Frequency	%
Measures of radiation protection	Weak	9	64.3
	Medium	3	21.4
	Satisfying	2	14.3
Control after X-ray exposure	Yes	-	-
	Boop	14	100
traffic sign	Yes	-	-
	Boop	14	100
Completion time special examination	20 minutes	6	100
Wastewater management of the CN	Yes	2	18.2
	Boop	9	81.8
Dosimeter monitoring	Boop	14	100
Diseases caused by ionizing radiation	blood cancer	3	25
	Sterility	3	25
	Cataract, dry skin	3	25
	Myopia	3	25

The following objectives were set for this study:

- Describe the characteristics of the radiology department staff in Mbujimayi hospitals;
- Determine the level of compliance with radiation protection rules by the radiology department staff of Mbujimayi hospitals;
- Identify the risks of ionizing radiation.

The research that we carried out in the eight health structures of the city of Mbujimayi helped us to retain certain data which are the subject of our discussion.

4.1. Socio-Demographic and Economic Characteristics of Radiology Service Personnel

The results of Table I can be explained by the fact that most of the hospital staff in the city of Mbujimayi are over 55 years old, *i.e.*, 57.1%. These results are in line with those of Gaston Nduenge (2016) who shows that 52.4% are 50 years old [10].

Compared with the sex of the staff surveyed, 78.6% of the staff are male and 21.4% are female, contrary to the results found by Jaouad Smani (2013) showing that the female sex was in the majority, *i.e.*, 61.8% [11].

Regarding the staff profile, 42.9% are administrative staff. These results go in the opposite direction from those of Gaston Nduenge (2016) who show that nurses are in the majority with 61.9% [10].

Compared to the training received in radiation protection, 100% of the per-

sonnel did not receive appropriate training in radiation protection and 83.3% did not have competent personnel in the field of radiation protection.

4.2. Main Features of Protective Measures

Regarding the wearing of a led apron, 64.3% are equipped with a led apron. These results are in line with those found by Jaouad Smani (2013) who shows that 80% of workers protected themselves with a lead apron [11]. Compared with wearing a dosimeter, 100% of personnel do not wear them. These results are contrary to those found by Kouassi YM (2011) which shows that 59.8% wore a dosimeter [8].

4.3. Characteristics Linked to the Risks of Ionizing Radiation

With regard to the radiation protection measure, 64.3% of the personnel declare that the radiation protection measures are weak. These results go in the same direction as those found by Kouassi YM, Op. Cit which reveals that 100% of the subjects of the study declared not to have a traffic zone precision plan and do not have a plan of intervention in case of radiation protection [8].

Compared to the X-ray danger warning sign 100% of radiology departments do not have a warning sign. These results are in line with those found by Jaouad Smani (2013) who shows that signaling only existed in 18.2% of radiology department establishments [11].

With regard to monitoring by dosimeter, 100% of personnel are not monitored by dosimeter. These results go in the opposite direction to those found by Jaouad Smani who shows that 65.5% of personnel are monitored by dosimeter [11].

In relation to illnesses caused by ionizing radiation, 25% believe it is blood cancer, 25% of staff think it is sterility, 25% of staff speak of cataracts, dry skin and 25% of staff cite myopia. These results are contrary to those found by Gaston Nduenge (2016) who shows that 80.9% of staff speak of blood cancer, 88.9% of sterility and 4.8% of myopia [10].

5. Conclusions

The use of X-rays in the hospitals in the city of Mbujimayi poses a problem, because the level of observance of the rules of radiation protection by the radiology personnel of the hospitals in Mbujimayi is insufficient.

Ultimately from the above, our results show that no structure in the city of Mbujimayi complies with the regulations on radiation protection and the level of compliance with radiation protection measures is low.

Compliance with radiation protection measures can begin with the best knowledge of the rules by the personnel working in the radiology department.

Observance of radiation protection rules by radiology personnel reassures, guides, directs and serves as a shield against almost all the risks of ionizing radiation. This requires the health authorities to ensure compliance with radiation

protection standards, in particular: physical and periodic inspection of installations plus equipment; dosimetric monitoring of radiology department personnel; the installation of means of radiation protection for the staff (leaded screen, led apron, led goggles, led gloves, sex shields, etc.).

Conflicts of Interest

The authors declare no conflicts of interest.

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Abbreviations

CN: Darkroom
HGR: General Reference Hospital
IRSN: French Institute for Radiation Protection and Nuclear Safety
ray: X-Rays
CSPAIR: Central Service for Protection against Ionizing Radiation
DRC: Democratic Republic of the Congo