

Interventional Radiologists: a Necessary Evaluation of Technical, Protective and Technological Operation

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ABSTRACT

Background and purpose: To present the results of occupational radiation doses investigated through a Hospitals of Mazandaran Medical Science Universities in north of Iran. Radiology unit has an important role in diagnosis of many disorders with providing suitable and high quality pictures. A good picture was provided using correct technical criteria and suitable circumstance of patient. Finally, operation and knowledge of radiology personnel directly has a primary role in determining quality of radiography.

Materials and Methods: This study was done in order to determine personnel operation in the units of hospitals radiologist related to University of Mazandaran Medical Science. Data collection tools are made of a researcher check list that was used after obtaining suitable letter and validity indexes. All of the 73 personnel of radiology unit related to Mazandaran Medical Science were studied. 35 operations (in technical, protective and technological fields) of any personnel, in three distinct shifts were observed and recorded. All of them were tested regarding these three fields with a total of 40 questions. **Results:** The total scores received from personnel in technical part in the morning, evening and night shift were 66.4, 53.9 and 60.2 percent respectively. Received scores from personnel in the protective fields were 68.1, 59.5 and 60.2 percent. Moreover, received scores from personnel in the technological operation fields were 47.8, 39.95 and 43.65 percent respectively. Comparison of these three scores in technical, protective and technological operation fields showed a meaningful difference ($p < 0.05$). **Conclusion:** The overall quality of personnel operations were nearly desirable and in need of continuous education, supervision and evaluation. Emphasizing protection to beams, accessibility of necessary tools, continuous supervision regarding the usage of these equipments and respecting the other security points have an important role in decreasing patients absorbed doses.

Key words: Radiography, Radiology unit, hospital personnel, proficiency.

1. INTRODUCTION

Radiology is one of the most important units in hospitals that aid physicians for the diagnosis of disorders. The base of radiography is making a suitable picture diagnostically and is protective of patients against radiations. Despite the advantages of this radiation in medicine, using this resource, one should be cautious and should be cognizant of ALARA law to minimize unnecessary radiations to patients and personnel (1). This responsibility is the duty of radiography personnel. An extended range of factors in radiography is controlled by radiography personnel to minimize absorbed radiations while maintaining the value of the diagnostic picture. It's noticeable that in many cases quality of picture affected while patients absorbing radiation changes.

In the last 70 years, the yearly average of absorbed radiation in people has become duplicated from ionization radiation, with increasing radiography, it's necessary to think about radiance control of X-rays and the volume of radiation in people. There are many important cases in decreasing the volume of absorbing radiation. Disregarding the radiation field proportion, using long-time irradiation, disregarding distance between the tube of X-ray to the body and discussing leaden safeguards will increase absorbed doses in patients.

The European Union designed a program as "guide lines in radiography pictures quality criterion" and recommended countries to consider its guide-lines. Muhogora, in his research in Tanzania reported: Considering guidelines of European Union in taking pictures,

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decrease the volume of patients absorbed radiation doses from 50 to 70 %. Moreover, Almen and Tingberg in their research in Sweden reported that doing radiography according to guidelines of European Union is a useful tool in increasing the quality of pictures. Wogner in Texas did a review on radiography techniques and bases during 15 years.

According to this research, he confirmed the necessity of radiography technical education, in radiography units in order to prevent radiography units of radiobiological injuries. Kurtz (2000) conducted a study through that a four - weeks education, pertaining to radiation techniques and ray center and showed the performance of people after education, has a good influence on improving the quality of pictures (1).

- As Low As Reasonably Achieved -

The results of Krutz researched (2000) that was provided on 532 radiologists by the first - year residents and the personnel of radiology, showed the performance of residents in radiology were weaker than personnel operations, however, after radiology education during 4 weeks duration to residents and comparing these two groups again; the operation and knowledge of radiology residents showed better results. Results of this research was done by Brucel in (2000), in 112 Universities and in University Radiology Centers in the United States, showing the score of full-time official personnel operation were higher than non-official part-time technologist operation (2-17).

Society's health is dependent on proper health services and prevention of diseases in many ways. Because ion - making radiations are important factors in generating radio biologic symptoms such as cancers, its necessary to determine the factors that cause increasing absorbed doses in people, and decrease the repeating radiology percent and absorbed doses with careful educational programming. Therefore, this research was carried out to determine the operation and knowledge of radiology personnel regarding radiology principles and protective points.

2. MATERIAL AND METHODS

This study is a descriptive and separate research that was done to determine the operation and specialized knowledge of radiology personnel. Research subjects were operative personnel in Radiology Center of University related to Mazandaran Medical Science University (20 hospitals) in which all of them (73 people) participated in this study. To collect data, a check list was prepared by a researcher. This check list contained a scientific questionnaire, a radiologist questionnaire and an observational check list.

Determining validity check list, we used a content validity index by the point of view of 7 radiography specialist. Furthermore, an observational check list in 7 cases was completed by a researcher and a radiology expert.

The check list contained a scientific questionnaire, to gather the knowledge of personnel, entailed 30 technical questions, 10 protective dosimeter and 10 technological questions. Radiologist check list contained 15 questions dealing with radiologists ideas as technologically responsible pertaining to the volume of technical, technological and protective consideration.

Observational check list completed by the researcher contained a 35 objective research on considering the volume of

triple points of technological, technical and protective in morning, evening and night shifts. The data was collected by a researcher attending a radiology center, without notifying personnel, observing their operations in the morning, evening and night shifts and recorded the results in the check list. Also, the questionnaires related to radiologist were completed by centers radiologists, personnel questions collection, was given to any personnel by researcher without referring to books and with others information, just to determine the individual knowledge of every personnel who responded concerning technical, protective and technological fields.

Because of the diversity of observational cases and completing the check list, a lot of time was spent with them. After collecting the data, the internal stability of technical, protective and technological results and total check lists in every three shifts was calculated. (The minimum confident index was 68% and the maximum was 79%). The questionnaire scores in every part of technical, dosimeter, protective and technological was calculated separately. The average and deviation of total scores and scores in every fields and also separately for experts and technicians were calculated to official and non official personnel. Also, a project was considered and compared with statistical tests.

Calculated average and deviation was also considered by the radiologists questionnaire then, was analyzed by observational check list. To analyze data, central indexes, distribution and T-Statistical tests was used which was significant. ($P < 0.05$).

3. FINDINGS

Considering results on radiologist personnel of 20 hospitals in Mazandaran Medical Science Universities, (a total of 73 people completed the forms). Out of 73 people, 48 people (65.80%) were technicians and 25 people (34.2%) were ex-

No	Protective Operation Subjects	Morning%	Evening%	Night%	Total%
1	Consideration of 180 cm distance in lung radiography	78	67.5	80	75.2
2	Educating of deep breath in lung radiography	70	59.6	50.5	60
3	Educating of deep exhalation in abdomen radiography	4	0	0	1.3
4	Radiography from ankle and knee with distinct radiation	22	24	16	20
5	Radiography from Palm and wrist with distinct radiation	60	56.7	44	53.5
6	Radiography from forearm and wrist with distinct radiation	54	43.2	40	45.7
7	Radiography from para nasal sinuses in position sitting to stand-up	82	51.3	52	61.8
8	Open mouth in sin use radiography	96	94.5	80	90.2
9	Neck cross table radiography in trauma patients	86	67.5	68	70.5
10	Considering fitting dimensions of cassette and body	90	81.08	84	85
11	Nose radiography from right and left side	66	35.1	28	43
12	90° primary open elbow in forearm profile	78	56.7	52	62.2
13	30° angle in knee profile	38	21.6	20	26.5
14	Putting marker in a suitable place	74	56	52	60.7
15	Quick services to emergency patients	98	94.6	100	97.5
16	Total	66.4	53.9	51	57.1

Table 1. Abundance percentage of personnel operations working in units of Radiography in Mazandaran Medical Science Hospitals in technical part.

No	Protective Operation Subjects	Morning %	Evening %	Night %	Total %
1	Considering the minimum distance of tube to patient	78	67.5	80	75.2
2	Non – accompanying patients at room during radiography	70	59.6	50.5	60
3	Closing door during radiography	4	0	0	1.3
4	Lead protector for patient companion in radiography room	22	24	16	20
5	Legal considering of distance square reverse	60	56.7	44	53.5
6	Radiography from forearm and wrist with distinct radiation	54	43.2	40	45.7
7	Radiography from paranasal sinuses in position sitting to stand-up	82	51.3	52	61.8
8	Suitable second kilo volt and Mile Ampere	96	94.5	80	90.2
9	Elimination of metallic things from radiography place	86	67.5	68	70.5
10	Putting marker	90	81.08	84	85
11	Putting gonad and thyroid protector for patients	66	35.1	28	43
12	Total	78	56.7	52	62.2

Table 2. Abundance percentage of personnel operations working in Radiography centers in Mazandaran Medical Science University Hospitals in protective fields.

perts. In addition, the number of project personnel were 17 (23.3%), conventional were 14 (19.2%), and employment were 42 (75.5%). Average of project personnel ages was 23.6 years (deviation factor) 1.3, conventional personnel was 26.7 (2.6) and employment personnel was 35.6 (9.2). (Table 1). Average of project personnel correct answers to all questions was 50.6 %, for project experts was 52% and for project technicians was 49.3.% Furthermore, the average score to technical, dosimeter and technological questions were 71.7, 35.2 and 38.8 percent, respectively.

No	Protective Operation Subjects	Morning %	Evening %	Night %	Total %
1	Machinery warm-up when tube is cold	78	67.5	80	75.2
2	Screwing selectors gently	70	59.6	50.5	60
3	Screwing tube in correct side	4	0	0	1.3
4	Extrication of tube lock after ending radiography	22	24	16	20
5	Tests of radiance field conformity	60	56.7	44	53.5
6	Tests of determining film foggingness	54	43.2	40	45.7
7	Correct making of appearance and stability substance	82	51.3	52	61.8
8	Test of cassette light diffusion	96	94.5	80	90.2
9	Darkroom machine servicing	86	67.5	68	70.5
10	Screen install and service	90	81.08	84	85
11	Adding any shift separately	66	35.1	28	43
12	Total	78	56.7	52	62.2

Table 3. Abundance percentage of personnel operations working at Mazandaran Medical Science university hospitals in technical field.

The average of all correct answers to questions for project personnel was 63.9%. Also, the average of correct answer to technical, dosimeter and technological questions were 79.11, 50.8 and 38.4 percent, respectively. The average of correct answers to questions for employed personnel was 59.02 % (60.42 % for experts and 58.08% for technicians). Separation average for technical, dosimeter and technological questions were 64.5, 51.8 and 45.6 percent, respectively (Table 2). The average answer for employed personnel with acquaintance lower than 10 years was 62.2 %. (Table 2). In questionnaire related to radiologists of hospitals centers who are considering work in technical and protective fields, the total average of answers was 71% and in observational check list was 57.9 %. In observational check list in technical field the total percent was 57.1 and separately in morning, evening and night shifts were 66.4, 53.9 and 51 percent, respectively. (Table 3). In protective field, the total average was 62.6 % and separately in morning, evening and night shifts were 68.1, 59.5 and 60.2 percent, respectively. In technological field, the total average in all three shifts was 43.8 % and separately in morning, evening and night shifts were 47.8, 39.9 and 43.7 percent, respectively.

Overall, calculated percents in all three technical, protective and technological fields in morning shifts were higher than evening and night shifts and their differences was significant ($P < 0.05$). Considering the numbers of correct answers to important questions in dosimeter and technological, the percentage of correct answers to these questions were: a) where should a dosimeter control film be installed? (26.3%); b) Which side should the tube in cross table radiography? 45.2.%; c) what is the minimum distance in radiography during portable radiology from machine? (43.8%); d) What is ALARA? (Just 12.3%); e) How many doses hit to gonads patients in abdomen and pelvis radiography? (Just 2.7%).

The following technological questions were investigated:

a) Do you know how to consider the deviation volume of radiance and light field?

b) Describe considering of the volume to film pollution in the darkroom?

c) What is the suitable temperature for stability and appearance of substance?, the correct answers were 13.7, 2.7 and 53.4 percent, respectively. In considering the volume of observing the quality and protective rules about limitation of radiance in observational check list, it was found that 46.4% observed, while, it was 67.5 % according to radiologists ideas.

Total average for all personnel whether project employed or conventional, for total, technical, dosimeter and protective and technological was 59.8, 71.7, 46.8 and 40.9 percent, respectively. Average and technological fields in all three shifts are illustrated in the tables. In calculating the average of technical, protective and technological fields, t-test was used according to personal characters like age, sex, organizational post and history of work.

Comparing scores in triple shifts and triple fields (technical, protective and technological) and also comparing the way of employment among project, conventional and employed personnel and comparing the changing list among technicians and experts showed a significant difference, It should be noted that the average of operation percentage in the morning shift was higher than the other and the average score in protective

field was higher than the others, as well. The average of questionnaire scores in conventional

Personnel were higher than the others in the technical field was the most and in experts was more than technicians. Personnel operation way is depicted in Tables 1, 2, 3) regarding technical, protective and technological fields.

4. DISCUSSION

Results of this study that was done to determine the operation of radiology personnel in hospitals related to Mazandaran Medical Science University in three technical, protective and technological fields, it showed that it was a low average of 59.8% for radiology personnel questionnaire, indicating lack of personnel knowledge level in formation that they use on a daily basis. Separate average for radiography technique questions, is higher than 71.7% and for this, it's more important in their work routine, lack of personnel information regarding dosimeter protective and technological field (46.8 and 40.9, respectively), indicating sufficient disregard for personnel in these cases, despite their role and importance.

In a comparative investigation among experts and technicians in all three groups, the average answers for experts was higher than the technicians ($P < 0.05$) indicating, increasing personnel knowledge, while advancing their education level.

In considering observational check lists, the average of correct answers were calculated to be 54.5%. This indicates a disregard for sufficient knowledge of radiography personnel. In a comparative investigation in triple fields, the lowest percentage involved technological field that may be contributed as the cause of damaging machines in radiography centers and one of the most important concern of low quality in radiography's. Also, in comparing investigations among the percentages of morning, evening and night shifts, answers and correct operations percentage related to personnel in the morning shift, were higher than the others. It appears, one of its causes, is the attendance of manager, radiologists and technical attendant in the morning shift.

There is a significant difference in observing technical and protective points (54.5 and 61 percentages, respectively) in comparing the observational check list and radiologists ideas that can be the result of radiologist's positive attitude in completing forms or not a sufficient acquaintance about real situations of the ward. The average correct answers to the questions pertaining to the ALARA was 12.3% and reached doses to gonads in abdomen and pelvis radiography was 2.7% indicating personnel, lack of information and their unawareness about the usage of this important law. Also, unawareness of more personnel about simple technical tests that every radiologist can control with the radiology quality, showed 2.1 and 13.7 percent in considering film capacity and deviation of radiance and light, respectively. These cases indicate the necessity of more attention to personnel's quality of education in universities and on-the-job.

Low average to correct answers for project personnel who had low acquaintance and was recently graduated, and who expected they could answer the questions with a high percentage, is the cause of low level of university educations about protection bases against radiance and the operation of technical tests. Moreover, high percent of correct answers

for new employed personnel may be the reason for readiness to participate in the employment test, because most of them were accepted one or two years ago.

Why the percentage of correct answer to protective, dosimeter and technological questions are lower than technical questions is the reason for emphasizing of the employment tests to these questions.

In comparison, considering between job history and personnel knowledge level, there was significant difference ($P < 0.05$).

The results showed for conventional and employed personnel with a history of lower than 10 years, the average of correct answers were 63.9 and 62.1%, respectively. The average of correct answers for employed personnel with a history of higher than 10 years was 57.4%.

Result of this study about using protective equipments showed that in many cases, the personnel do not use them against X-ray.

Therefore, it's necessary to continue with supervision by hospitals health staff to use leaden protection in organs sensitive to X-ray, due to the radiance dangers and more emphasis to be made to ICRP. Results showed that the average of correct answers by experts were higher than the technicians. Although the percentage of experts with correct answers regarding technical and protective fields, were higher than 50% in every shifts, however, the total percentage of correct answers in two fields at all shifts were 51%. This indicates not considering technical and protective points, emphasizing to protection by attendants, accessibility to enough protective equipments and continues supervision by attendants on using protective equipments and considering security points, have an important role in the lowering of absorbed doses in patients.

Total operation quality and personnel's knowledge were ideal. There fore, increasing personnel's knowledge needs to be a continuous education during working hours, attending supervision classes, consideration and more emphasis has to be made to the quality of university education.

Emphasizing the protection against radiance and continuous supervision concerning the usage of protective equipment and consideration of security points will have an important role in the lowering of absorbed doses in patients. Considering technical points also can play a role in improving the quality and the lowering of the absorbed doses in patients.

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