

Radiophilia: A Common Case of Excessive Radiation Exposure in Healthcare

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Abstract

Medical imaging using ionizing radiation is an increasing activity that brings tremendous benefits to the patients. But stochastic and deterministic effects of radiation, make it necessary to protect patients from potential harm. In this study, we report a common case of excessive radiation exposure in healthcare. We named it "Radiophilia". It can be defined as "unnecessary radiation exposure due to misunderstanding and underestimation of risk perception, risk conception and risk communication among healthcare employees involved in medical radiation imaging". Radiophilia is not a term to describe a phenomenon, but it is an inconvenient truth that is not justified any way. We discuss more on Radiophilia and address main reasons that may lead to this truth.

Keywords: Radiophilia; Radiation protection; Radiology; Healthcare; Risk; Knowledge

Introduction

Medical imaging plays a vital role in management of patients across all diseases and malignancies in modern medicine. Among many imaging techniques, computed tomography (CT) has undergone rapid technical developments that caused to be utilized as a remarkable modality for better diagnosis and treatment planning. The life-saving clinical benefits of CT have caused to CT become more successful modality in imaging issues. Therefore the frequency of CT exams has increased sharply during years 1981 to 2006 from 2.8 to 62 million scans, respectively [1]. Although CT accounts for 10% of all diagnostic radiological modalities, but it contributes up to 67% in the United States and 47% in the United Kingdom of the collective radiation dose delivered to patients [2,3]. In developing countries, also the use of CT as a new medical imaging technique has increased rapidly, so the inappropriate use of CT scan can lead to unnecessary exposures to radiation. Brenner in a highly cited paper mentioned CT is as an increasing source of radiation dose [4].

As we know, radiation is a well-known carcinogenic agent and it has well documented in many scientific papers and reports [5]. Epidemiological data have showed that 10–50 mSv of radiation in acute exposure and around 50–100 mSv for a protracted exposure can cause cancer. Also, studies have indicated an overall lifetime attributable risk (LAR) of cancer as a result of a single CT coronary angiogram is 1 in 82 in high-use groups [6] and between 1 in 143 and 1 in 3261 for 20-year-old woman and 1 in 3261 for an 80-year-old man, respectively [7]. It has been estimated that, in the United Kingdom, medical diagnostic radiation exposures may cause 100 to 250 deaths in each year [8]. To assess the radiation doses for neonates from diagnostic radiography which has been carried out in NICUs

(Neonatal Intensive Care Units) demonstrate the risk of death due to radiation cancer incidence of abdomens examination was equal to 1.88×10^{-6} for male and 4.43×10^{-6} for female. For chest X-ray, it was equal to 2.54×10^{-6} for male and 1.17×10^{-5} for female patients [9].

Based on International Commission on Radiological Protection (ICRP), radiation protection is predicated on the linear no-threshold (LNT) hypothesis, which implies relationship between dose and cancer risk proportionally, with no threshold [10]. Although the use of LNT for radiation protection is called a conservative model and some scientists have stated the use of CT may reduce rather than increase the risk of cancer [11] but LNT is remained as an acceptable model for radiation protection purposes. It means more caution should be taken into account and all radiation protection rules should be implemented by force and legally.

Paying attention to risk conception and perception about radiation protection standards are the same among physicians, radiation technologists, patients and public. So using radiation sign, shield and other safety considerations are respected at all levels. But due to some reasons not only the importance of risk conception and perception (not meant to Radiophobia) regarding to radiation safety and protection issues are disregard, but also there are disesteem and incuriosity among people how work directly in radiation area, as an abnormal behavior not only in individual manner but also for organizational treat which can be called "Radiophilia".

In this paper, we introduce "Radiophilaia" as an unusual phenomenon which occurs among somehow work with radiation in healthcare centers and employees who are involved in patient disease management.

Radiophilia

Medical imaging using ionizing radiation is an increasing activity that brings tremendous benefits to the patients. But stochastic and deterministic effects of radiation, make it necessary to protect patients from potential harm. In this study, we report a common case of excessive radiation exposure in healthcare. We named it "Radiophilia". It can be defined as "unnecessary radiation exposure due to misunderstanding and underestimation of risk perception, risk conception and risk communication among healthcare employees involved in medical radiation imaging". At last but not least, Radiophilia is an inconvenient truth that is not justified any way.

Discussion

There are variety reasons can lead to Radiophilia. They are some factors related to physician, radiological technician, patient, equipment and economic issues. We can summarize these points as below:

1. Deficiency of knowledge and awareness on radiation protection, especially emphasizing on ALARA (As Low as Reasonably Achievable) policy.
2. No pay more attention to three fundamental principles: justification, optimization and dose limitation.
3. The increasing number of less experienced and careless clinicians who request images due to their incorrect diagnosis or absence of Physical examination.
4. Undermining the importance of ALARA principle among radiation technologists because of their low income-demanding job.
5. Lack of knowledge and education about radiation protection for patients and their insistence to experience imaging. Because requesting shielding devices by patients could be alarm for radiation staff.
6. Ignoring optimization such as paying careful attention to field size in radiology and choosing appropriate CT Scan protocol whit excuse saving time among radiation technologists
7. Whit increasing of image requests for traumatic patients and shortage of immobilization and other accessories in the medical imaging departments cause the companions of patients are espoused with radiation.
8. Loss of proper performance of local organizations responsible for radiation protection and failure to provide, follow up, and implement radiation protection rules
9. Insufficient education about practical concept; Diagnostic Reference levels (DRL) in order to address some questions like "Why should one radiology facility use protocols that lead to 10, 20, or 126 times greater dose, compared to other facilities, to produce similar radiographic images?"
10. Non-availability of digital equipment and PACS (Picture Archiving and Communication System) systems in many radiology departments
11. Inadvertence to importance of radiation effects concerning diseases owing to the increase of hazardous diseases such as cancer in all of the world
12. Lack of practical radiation protection training courses for technician of radiology students
13. Reduction of interest for medical physicists to diagnostic radiology field owing to lack of defined job position in some developing countries for them such as Iran.
14. Disremember of radiology images as legal and medical documents
15. Lack of attention to quality control of radiation units, image quality and patient dose assessment.
16. Absence of radiation safety officers in diagnostic radiology departments daily.
17. Putting too much value on low dose radiobiology phenomena (such as radioadaptive response and radiation hormesis) that contradict LNT assumption for risk assessment among some radiation scientists and their impact on radiation protection issues
18. The conservation and high costs of radiation protection issues among radiation scientists.
19. Not knowing more about organization in which emphasize about radiation safety such as International Atomic Energy Agency (IAEA), the Commission of European Communities (CEC) and National Radiological Protection Board (NRBP). Also for pediatric and adult individually as the Image Gently and the Image Wisely Alliance, respectively.

The physician knowledge and awareness about radiation dose and risk can be the first step to remove unnecessary radiation exposure and so justification of the process. But, there are many studies that show this knowledge on different radiological procedures particularly CT scans and other radiological examinations is inadequate [12-15]. Krille et al. evaluated the available literature on physicians' knowledge regarding radiation dosages and risks due to CT in 2010 and concluded only minorities of physicians were well informed about radiation protection awareness particularly for CT and this awareness should be improved [16]. Also, in a questionnaire based study, Wong et al. evaluated the awareness of radiation exposure related to radiological imaging while their results represented that health professionals' knowledge on radiation doses for CT scan imaging was poor and inadequate [17]. Moreover, in pediatric radiology exams, higher ESD s acquired for chest examination were related to the use of low kVp, relatively high mAs and use of the grid for most of the pediatric patients [18]. However, the risks versus benefits of each method should be considered, especially radiation effects are cumulative. In fact paying more attention to basic rules are necessary as the Image Gently campaign's message of "Back to Basics". This campaign is a program designed to educate staffs of medical imaging teams and the public about the fundamental safety measures, procedures, and parameters of digital radiography.

Conclusion

Radiation protection in healthcare is a wide subject that needs basic understanding of risk. All three rules of radioprotection (justification, optimization and dose limitation) are based on this issue that how we can manage the radiation risk truly. But lack of knowledge and training among all healthcare employees may lead to a tragic phenomenon called Radiophilia. We recommend training programs, education, specialized health physics classes and ongoing assessment during the course of medicine to improve understanding of radiation risks. On the other hand, patient's awareness and a continued collaboration among radiologists, radiation technologists, radiation protection officers and all physicians to creating local protocols , dose/risk tables and software can reduces unnecessary CT requests and hence radiation risks. patient awareness and concern regarding the potential health risks from ionizing radiation can reduce unnecessary radiation exposure.

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