

A prospective study assessing clinicians attitude and knowledge on radiation exposure to patients during radiological investigations

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Abstract

Background: Exposure to radiation during radiological investigations is of health concern, which referring physicians should rationalize. Hence, we assessed the clinician's awareness and concern of radiation exposure to patients, in relation to their referral practice. **Materials and Methods:** A prospective study was conducted involving specialists from Punjab (India), who were handed a standard set of questionnaire concerning knowledge of radiation hazards and doses from imaging procedures, consideration of radiation dose and age when referring, referrals not likely to affect treatment, and use of referral guidelines were included. Of the 150 medical doctors given the questionnaire, 106 returned it. **Results:** Majority of the clinicians underestimated radiation doses, while a few overestimated it. Almost half of the clinicians (55.5%) favored to select the rationale of asking about previous radiological examinations as clinical need only, which was surprising. Rates of referrals unlikely to affect treatment were more (66%) than reported rates in previous studies. Worryingly, only 30.1% of the clinicians had knowledge of referral guidelines and alarmingly only 10.5% had made use of it. **Conclusions:** Our study although in a small population size identifies inadequate knowledge on radiation and its guidelines among referral physicians, which warrants the immediate need for training programs to bridge this knowledge gap.

Key words: Knowledge, attitude, radiation, hazards, exposure, questionnaire

INTRODUCTION

Radiation exposure from medical imaging has come under scrutiny due to increased risks of cancer associated with repeated radiation exposure.^[1,2] In the United Kingdom, approximately 100-250 deaths occur every year from cancers directly linked to medical exposure to radiation.^[1] Justification and optimization are the radiation protection principles indicated by the International Commission on Radiological Protection. Hence referring clinician must

know the amount of the radiation dose given to patients and the possible harmful effects of this exposure in order to justify a radiation-based medical imaging procedure. While clinicians are proficient in assessing clinical benefit to an individual patient from a radiological procedure, deliberation of radiation risk has been lacking. Approximately 3.6 billion diagnostic radiological examinations are performed globally every year, a figure likely to go up in the future. The lack of knowledge concerning radiation exposure by referring clinicians could be counterbalanced by use of referral guidelines. Indeed, previous studies have reported the inadequacy of knowledge about ionizing radiation and its carcinogenic potential among referring physicians in the absence of referral guidelines. Surprisingly, a minimum of 20-40% of computed tomography (CT) scans could be avoided if clinical decision guidelines are followed.^[3-21] However, in developing countries such as India data on the significance referring clinicians attaches to radiation awareness, exposure history and radiation risks to

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patients are not available. Hence, we examined the level of knowledge and attitude of referring physicians have regarding radiation received by patients when they go through commonly requested radiological investigations.

MATERIALS AND METHODS

Study participants

In this study from the state of Punjab (India), doctors of clinical specialties were asked to complete an anonymous questionnaire. Questionnaire was handed out to the total of 150 participants who were hospital physicians at all grades except radiologists, radiation oncologists and nuclear medicine physicians. Demographic details relating to specialty and level of experience (resident and consultant) besides age/sex and contact particulars was collected. The authors requested everyone to distribute the questionnaire with referring physician colleagues. This was required in order to broaden the participant base. Wherever possible, the author(s) supervised the session to make sure that answers are unaided.

Contents of the questionnaire

We designed the questionnaire based on the literature review. Participants were asked to make out the mean doses of radiation received, in terms of number of chest X-ray (0-1, 1-10, 10-50, 50-200 or 200-400) during various radiological investigations. The participants were also asked to sort out the radiation injuries into deterministic and nondeterministic effects. Questions on understanding of radiation measurement units, utilization of referral guidelines, and age-related radio-sensitivity were incorporated. Attitude of referring clinicians was assessed by the questions concerning the importance they attach to acquiring information on past radiological examinations, opinion on whether patients should be given information regarding radiation dose, consideration of radiation dose when referring, rate of and rationale for referrals improbable to have an effect on treatment.

Scrutiny of the answers to the questionnaire

Numbers of clinicians who selected a specific answer in a question and the corresponding percentages of each answer were calculated. Two-tailed Fisher's exact test was applied to calculate whether the differences in answers between physicians working in different specialties and residents versus consultants were statistically significant. During the scrutiny, likely answers for every question were labeled as correct (C) or Incorrect (C) and positive (P), negative (N), or neutral. Data were evaluated using SPSS (version 16, SPSS Inc., Chicago, IL). A two-tailed $P < 0.05$ was set as statistically significant.

RESULTS

Demographic information

Of the total of 150 participants, 106 questionnaires (71%) were returned after completion. Rest of the 44 participants did not return the questionnaire or did not respond to all questions and were hence excluded. The mean age (range) of participants was 34.2 (24-62) years with a male predominance (66%). The average experience of all clinicians (including postgraduation years) was 8.2 years (1-35 years). The main specialties of 106 hospital physicians included Surgeons ($n = 25$), Internal Medicine ($n = 26$), Orthopedics ($n = 20$), Pediatricians ($n = 20$), and Gynecologists ($n = 15$). Of 106 respondents, 62 (58.4%) were consultants, 44 (41.5%) were residents.

Knowledge concerning radiation units, radio-sensitivity and adverse effects

Majority of the clinicians undervalued radiation doses (in terms of chest X-ray equivalent) from routine imaging. 70.1%, 60.6%, 58.1% and 57.6% of clinicians under-rated the doses for barium meal follow-through, thoracic CT, intravenous pyelography and abdominal CT respectively. Although a patient undergoing a CT abdomen would receive approximately 400 times the radiation of a chest X-ray, however the most common answer was 10-50 times, hence clinicians were submitting their patients to a radiation dose that was much more than they thought it was.

45.5% and 49% of participants overestimated the dose from abdominal and pelvic radiographs respectively. According to 12.5% and 9.8% of clinicians, magnetic resonance imaging (MRI) and ultrasound, correspondingly, had some radiation dose. Only 20 (18.8%) out of 106 clinicians declared they were familiar with deterministic and stochastic effects. When sorting six dissimilar injurious effects as either stochastic or deterministic, these 20 clinicians mean score (correct answers) was 50% ($n = 3$). Almost 80% of physicians stated that they found radiation units puzzling.

A gratifying 85.4% of participants answered accurately to question concerning the most radiosensitive patient group. However, concerning the least radiosensitive group of patients only 55% of participants answered accurately, and a considerable percentage of clinicians (45%) incorrectly stated that the least radiosensitive group were adult patients.

Consideration of the past and present radiation exposure to the patient at the time of referring

Majority of the clinicians declared that they occasionally enquire patients about earlier radiological examinations (never 15% and occasionally 50.1%, very often 20.9% and always 14.0%). Almost half of the clinicians (55.5%)

avored to select the rationale of asking about previous radiological examinations as clinical need only. About one-third (35.5%) selected the purpose of asking about previous radiological examinations as 'both' radiation risk, and clinical need and rest choose radiation risk only. More than half of the clinicians (61.1%) regarded patient age to be a chief factor in their decision-making for referring patients for CT scans. Taking into account a referral for imaging, clinicians in the total sample regarded radiation dose as equally important as patient's wish ($P > 0.05$), however less essential than the effect of the imaging on the patient's diagnosis, management or prospective health ($P < 0.05$).

Overall, 65.9% of clinicians affirmed that they do not feel awkward when patients ask about radiation hazards from radiological investigations they recommend. On the whole, 75.1% of clinicians declared that information about radiation dose in radiological investigations must be made available to patients in the written report of the examination.

Utilization of referral guidelines and Clinicians' self-evaluation of aptness of referral

Regarding the use of referral guidelines for imaging, we found that only 30.1% of the clinicians have knowledge of referral guidelines and only 10.5% had made use of it. Nearly one-third (66.5%) of the clinicians referred the patients for imaging that would not likely to have an effect on treatment. In contrast to the other listed reasons for referrals that barely have an effect on treatment, "patient expectations/satisfaction" and to avoid any medico-legal implications in case of missing any diagnosis on clinical examination were marked as more important.

Overall, there was no statistically significant difference ($P > 0.05$) among clinicians in different categories and with different experience.

DISCUSSION

This is first ever prospective study from India among referring clinicians on their attitude and knowledge concerning radiation exposure to patients from common radiological investigations, their familiarity about the radiation doses, exposure units, age-related radio-sensitivity and self-assessment of aptness of their referrals. Similar to previous studies, our report established that clinicians frequently undervalue radiation doses and had inadequate knowledge on radiation. Few even reported radiation from MRI and ultrasound.^[3-16] Even though in agreement with previous reports, it was noteworthy that only 10% of the clinicians had used referral guidelines, which is worrying

and significantly lower than studies from the developed world.^[22-25] Hence, there is a need for increasing awareness about radiation exposure among referral clinicians in our region.

Respondents rates of referrals unlikely to affect treatment were more than some reported rates of unjustified imaging in other studies (5-20% vs. 66%).^[26-30] In our study, this may be due to a variety of reasons such as: Inadequate radiation knowledge is not compensated for by means of referral guidelines as 70% of doctors were not even aware of these guidelines. Unlike in developed countries, in India there is no upper limit on the number of patients for the clinicians to see in 1-day, which are often hundred in numbers. These investigations likely compensate for the less than the required time given by doctors to the patients and appear to give sense of satisfaction to the patients. Moreover, with ever-increasing numbers of medico-legal cases on doctors, the later have become more conscious at the cost of more radiation dose exposure to the patient. Contribution of incentive or share based referrals by clinicians which are common in our experience also cannot be ruled out. However, it was very promising to know that clinicians on the whole agreed with the provision of providing information about radiation dose to patients and that majority of clinicians do not feel uncomfortable when patients enquire about radiation risk. Our study did not find any statistically significant differences among physicians in different categories and among clinicians with different experience suggesting that radiation knowledge needs to be improved at all levels and among all specialties. The sampling size and our participants from only a few hospitals in Punjab are limitations of our study and hence our findings may not be representative.

SUGGESTIONS AND CONCLUSIONS

Our study points towards inadequate knowledge of radiation risks among clinicians and lack of use of referral guidelines. Hence, it is advisable to put more emphasis on the radiation protection courses and education, as well as justification of referral for imaging among students and clinicians of all specialties at graduate and postgraduate level. Referral guidelines must be more vigorously circulated and put into practice. Nevertheless, the endeavors to improve referral practices also have to target clinician's attitudes in addition to their knowledge enhancement.

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