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Multicenter study assessing ophthalmologist's knowledge towards radiation dose when prescribing CT scans for pediatric patients: A Saudi Arabian perspective

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ABSTRACT

Purpose: To assess the knowledge of ophthalmologists towards computed tomography radiation dosage on children in the Kingdom of Saudi Arabia.
Materials and methods: IRB was granted prior to the commencement of this study. Between October 2014 and December 2014, 19 questions were distributed to 462 ophthalmologists in the Kingdom of Saudi Arabia via Survey Monkey online portal. Questions of radiation dose, risk, awareness and education participation were asked and a total score was aggregated. Samples t-test was used to evaluate their understanding of radiation doses of usual radiological investigations by finding out any significant difference from correct answers. Descriptive scrutiny of their understanding of risks of radiation and education were also executed.
Results: total of 46 questioners (10%) were returned. Physicians performed poorly with knowledge about radiation dose with more than 80% unaware of the ALARA principle, risks and alternative imaging modalities. Education demonstrated only 13% of respondents had any specific teaching towards radiation protection and the significance between years of experience except less than 1 year that the link between radiation exposures during head CT increases the likelihood of malignant tumors ($p < 0.05$).
Conclusion: Knowledge of Ophthalmologists towards the risk of radiation exposure in pediatric CT is poor and suggest a propensity of misappropriate radiation use and underutilization of alternative radiation-free methods. Structured education sessions and deliberation of the radiation dangers with patients are recommended.

1. Introduction

Radiation exposure from computed tomography (CT) is of increasing concern to pediatric patients, healthcare industry and the general public (Brenner & Hall, 2007; Frush, 2004; Kirpalani & Nahmias, 2008). This concern is magnified in pediatric populations, as children are more sensitive to the effects of ionizing radiation (Brenner, Elliston, Hall, & Berdon, 2001; Pearce et al., 2012). Resulting in, strategies to reduce CT radiation doses without comprising image quality (Goske et al., 2008).

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Professional education in dose reduction strategies includes limiting the use of medical radiation to answer clinically relevant questions. This model depends on the imaging competence of the ordering physician, the radiologist, and the technologist preforming the imaging (Almohiy, 2014; Almohiy & Davidson, 2011). These competencies have gained the public and professional spotlight as the long-term effects of medical radiation are debated. In addition to regularly updating its imaging appropriateness criteria, the American College of Radiology has also published white paper initiatives (Amis et al., 2007; Picano, Vano, Semelka, & Regulla, 2007), which are largely directed at increasing physician and technologist imaging expertise.

The level of cognizance concerning this issue has undoubtedly increased among pediatric radiologists. But is it the same with other physicians? UK studies (Quinn, Taylor, Sabharwal, & Sikdar, 1997) and the United States (Lee, Haims, Monico, Brink, & Forman, 2004) have forward for consideration that there is widespread worldwide underestimation of radiation amount by physicians managing adult and pediatric patients. Children are more radiosensitive than adults (Brenner, 2002; Huda, 2002; Theocharopoulos et al., 2006). However, the level of awareness among physicians, the health providers requesting examinations involving ionizing radiation on children, is not known. So we took up this survey to find out the level of understanding among opthalmologist's in Saudi Arabia of the radiation doses and dangers related with radiological investigations in children.

2. Materials and methods

Our study was a multicenter retrospective questionnaire study that included hospitals, universities and private clinics across the Kingdom of Saudi Arabia between October 2014 and December 2014. Ophthalmology physician recruitment was on a voluntary basis. 462 potential subjects were emailed via the online survey tool (Survey Monkey, 2014) 19 open and closed ended questions (Appendix 1). Our project was approved by our institutional review board. The questionnaire consisted of nine multiple choice, and two open ended structured questions. There were 3 sections which examined demographic statistics such as specialty and experience in years, their understanding on dose of radiation and fatal cancer risk.

2.1. *Statistical analysis*

The interior stability of each construct of the questionnaire was assessed through the Cronbach's Alpha Reliability. The data were scrutinized through the Statistical Package for Social Sciences (SPSS) version 20. For each construct of the questionnaire, descriptive statistics such as cumulative frequency, frequency, and relative frequency were calculated. In addition, the presence or absence of any significant correlation between groups was investigated through the Chi-square test method. This method is found significant when comparing results in terms of actual and expected outcome from the responses. The hypotheses test in the study was tested at 0.05 or 0.95 levels of significance, and was the confidence interval for the analysis of statistical findings.

3. Results

The questionnaire, together with the answers, is given in Appendix 1. Out of 462 questionnaires dispatched, number of questionnaires which were returned were 46 (return rate = 10 %). All the ophthalmologists were grouped into years of experience into the following; less than 1 year, 1–5 years, 6–10 years, 11–20 years and greater than 20 years (Table 1).

3.1. *Radiation dose awareness (questions 2–5)*

For question 2, all physicians responded; 44% of subjects were aware that radiation dose was administered, however, question 3; 92% was aware that there were alternative imaging investigations. Nevertheless, question 4 demonstrated that 15% of ophthalmologists understood the ALARA principle which is a risk benefit application to consider when employing radiation dose. Finally, ophthalmologists responded poorly (36%) regarding the link between radiation dose in CT and increase prevalence of cancer due to imaging (Table 2).

3.1.1. *Education (question 6–7)*

All physicians responded to education participation. Only 13% of respondents had any specific teaching regarding radiation protection during CT. Question 7 aimed at asking whether there was an effect on the lens of the eye due to radiation from a head CT, surprisingly 49% were aware (Table 2).

3.1.2. *Cross-correlation between years of experience and radiation dose awareness*

3.1.2.1. Cross correlation was performed on questions 8-10. Question 8 demonstrated significant findings across all years of experience except less than 1 year that the link between radiation exposures during head CT increases the likelihood of malignant tumors ($p < 0.05$). There were no significant findings between familiarity in the ALARA principle and radiation dose to the lens of the eye (Table 3). The likelihood ratio and Pearson's correlations demonstrated differences between each group without significance except for question 8.

4. Discussion

The results reveals that a substantial number of Ophthalmologists in Saudi Arabia have no equitable knowledge regarding delivery of CT radiation dosage, which poses a greater health risks for patients, especially the children. The study shows that more than 90 per cent of Ophthalmologists in Saudi Arabia have more than ten years of experience. This

Table 1 – Years of experience as an ophthalmology physician.

Years of experience	<1 year	1–5	6–10	11–20	>20
Number	1 (2.6)	2 (5.1)	10 (25.6)	12 (30.8)	14 (35.9)

Note – parameters in parenthesis are percentages (%).