Migration Letters

Volume: 19, No: S8 (2022), pp. 889-893

ISSN: 1741-8984 (Print) ISSN: 1741-8992 (Online)

www.migrationletters.com

Radiologists And Visual Acuity Testing

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Abstract. *Visual acuity (VA) and potential risks to the radiologist's eyesight have been relatively ne- glected subjects in the radiological literature. This study comprises two parts, the first consisting of a questionnaire on this subject sent to a random sample of 480 practising radiologists in the [1]United Kingdom, and the second, a spot check of the VA of radiologistsin our department. Of questionnaires, 73 % were re- turned. Of respondents, 76 % felt that ionising radia- tion could affect their vision, but only 13 % used lead glasses on a regular basis. A total of 71 % felt that regular monitoring of eyesight should be re- quired. Of 25 tested radiologists, 5 had suboptimal VA and could benefit from further correction. The pertinent literature is reviewed, and a case for peri- odic eyesight testing is presented, including VA and grey-scale discrimination.*

Keywords: *Visual acuity – Radiologists – Monitoring*

Introduction

The relevance of visual acuity (VA) to practising radiologists is not a subject which has been investigated or dis- cussed extensively. A few articles in the literature men- tion the possible relevance of VA on the perception of image quality [1, 2], but only one paper has discussed the subject in more detail [3]. We decided to survey the attitudes of practising radiologists on this subject and also to perform a spot check of the VA of radiolo- gists in our department.

Methods:

A questionnaire was sent to 480 radiologists whose names were selected at random from the Royal College of Radiologists' mailing list. The questionnaire is sum- marised in Table 1. At the same time we performed a spot check of the VA of 25 radiologists attached to or visiting our department. A group of 18 men and 7 wo- men volunteered (age range 27–63 years). These tests were carried out on a voluntary basis and were therefore self-selected, which may slightly bias our observations, although 25 of 27 radiologists participated. Visual acuity was assessed using Snellen and Jaeger charts, and the re- sults were discussed with an optometrist. We were un- able to include a grey-scale discrimination/contrast sen- sitivity test as part of the assessment.

Results

X-ray technician, Riyadh Health Authority, Riyadh[1]
Specialist-Radiological Technology, Riyadh Specialized Dental Center, Riyadh[2]
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X-ray, King saud medical city, Riyadh[4]
X-ray, Al Rawda Health, Riyadh[5]
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[10]X-ray technician, Primary health centers

Of the 25 radiologists tested, 20 (80 %) had the equiva- lent of 6/6 VA with or without corrective lenses and 5 (20 %) had lower acuity. It was felt that this latter group might benefit from either corrective lenses or an altera- tion in their existing prescription.

Table 1. Summary of questionnaire

Personal details/grade
Work practice/sub-speciality
Estimated weekly exposure to ionising radiation
History of previous visual problems/acuity testing
Type of occupational health assessment
Perception of personal risk/awareness of radiation-related eye disease
Use of protective eye wear
Awareness of any relevant health and safety guidelines
Attitudes to periodic visual acuity testing, and further comments

Table 2. Results of questions on previous eye testing

Previous eye test	76%
Before radiology career	39%
During radiology career	61%
Indications for eye test	
Visual problems	
Headaches	
Affecting work	18%

would be needed to result in cataract development under the protracted radiation exposure to which radiologists are subject [5]. It is doubtful that most radiologists are at any increased risk of cataractogenesis, but those in- volved in interventional procedures or excessive screen- ing may be. There may be a place for monitoring these individuals on a more regular basis to try and avoid any potential radiation damage to the lens. Our survey shows that although most of the respondents are aware of and respect the potential risk, few actually use protec- tive measures such as lead glasses or screens. This may be related partly to poor design of these aids in which case consultation and discussion with their manufactur- ers may be of value.

Table 3. Civil Aviation Authority Visual Standards for Flight Crew

Distant visual acuity:	6/9 in each eye tested individually Spectacles and contact lenses are acceptable. If correction is required the minimum acceptable uncorrected VA is 6/60 in each eye
Near visual acuity:	N 5 at 30–50 cm in each eye tested individually, and N 12 at 100 cm

The second part of our study shows that within our department 5 of 25 radiologists could improve their VA, although at the time of testing they had not noted any problems with their vision. It has been shown that decreased VA increases the threshold contrast required to detect and identify high-frequency information [6]. A direct relationship has been shown between resolu- tion and the contrast required for detection of high-frequency information (□2-line pairs/mm), on images viewed at distances of 30 cm or more. High-frequency information may not be important in all aspects of radi- Of the 480 surveys, 350 were completed and returned (73 %). Of the respondents, 72 % were consultants, 20 % were registrars and 8 % were senior registrars. The mean age of respondents was 40 years and the average length of time in radiology was 22 years. Most respon- dents classified their working practice as "general" with only 0.85 % considering interventional radiology as their main practice. A further 15 % considered inter- ventional radiology as a major aspect of their workload. Of respondents, 8 % were involved primarily in mam- mography and 30 % in ultrasound. Estimates of per- sonal exposure to ionising radiation varied widely, with junior staff reporting a higher exposure time generally.

Of the study population, 74 % had undergone eye testing (see Table 2). The major indication was for visual problems, but headaches and problems related to work accounted for 18 % of the reasons for eye testing. Of the 41 % of respondents who had had an occupational health assessment prior to starting their radiology ca- reer, 9.8 % had had their eyes tested as part of this.

The majority (76 %) felt that "radiology" or ionising radiation could affect their vision, and interestingly, it was junior respondents who were least likely to think so. All respondents considered cataracts to be causally related to radiation exposure, but 7 people also consid- ered retinal vein thrombosis to be a potential risk. We have not found any reference to this in the literature.

Only 23 % of radiologists stated that they ever used protective lead glasses or shields. Of this group only 13 % used these on a regular basis. The main reason gi- ven for not using lead glasses was their poor design, the fact that they generally feel uncomfortable, that they fog over or fall off, and that they are not easy to use over one's own prescription lenses. Of those surveyed, 37 % were aware of the 1992 Health and Safety Regula- tions related to Display Screen Equipment work, and 98 % of these radiologists felt that the guidelines were of relevance, both for personal or safety reasons and for potential effects on work efficiency.

To our final question 71 % of respondents felt that regular monitoring of VA should be required for practi- sing radiologists. A larger group, 82 % of the total, were agreeable to undergoing such testing, should this be pro- vided. Concern was expressed that this monitoring would have to be done professionally to be of any value, and some doubts were expressed as to the ability of oc- cupational health departments to provide this service adequately.

although other factors such as training, knowledge, viewing distance and image quality have generally been regarded as more important. However, in all these stud- ies it is

commented that the subjects tested all had near- normal VAs, and that a stronger relationship between VA and lesion/nodule detection would become evident as the VA worsened [2]. Visual acuity is easily measured and corrected, but very little has been written regarding its importance to practising radiologists. We found only one recent paper addressing this topic, in which the au- thors also attempted to establish the attitudes of radiol- ogists in their department towards requirements for pe- riodic testing [3]. There is a progressive normal deterio- ration in VA with age which will affect all radiologists, and in addition, there may be an increased effect from the non-stochastic effect of ionising radiation on the lens. The lens is amongst the most radio-sensitive tissues in the body, and opacities can develop which may lead to visual impairment. The pathogenesis involves damage to dividing cells in the anterior epithelium which then migrate posteriorly to accumulate beneath the capsule of the posterior pole of the lens. This accumulation of damaged cells and breakdown products causes posterior displacement of the lens bow and leads to a small central posterior subcapsular opacity. If this lesion progresses it can extend to involve the anterior cortex and nucleus of the lens eventually leading to the development of cata- racts.

Discussion:

Radiological interpretation and diagnosis depends on a number of factors. One of these may be the radiologists' innate visual acuity. Several studies have shown that this may be of relevance in the detection of lesions [1, 2, 4], ology, such as nuclear medicine, but in a number of other tasks it may be vital as in the detection of mammo- graphic microcalcifications. There is increasing recogni- tion that contrast sensitivity or grey-scale discrimination tests should be included in visual assessment [3, 6, 7, 8]. This can be performed using tests such as the Pelli-Rob- son, in which the letters decrease in contrast rather than size. Contrast sensitivity tests give additional informa- tion about low to intermediate spatial frequency defects, whereas VA tests assess high spatial frequencies. Con- trast sensitivity decreases with age, but the effect of this on visual function is not yet fully established [8]. In the case of cataracts, deterioration initially affects mainly high spatial frequencies, but posterior subcapsular cata- racts may cause contrast sensitivity loss earlier at low spatial frequencies [7]. There is an increasing emphasis on quality assurance and unfortunately an increase in litigation after missed lesions, at least in the United States [3]. This may increase with a growing number of radiology screening programmes being implemented. As a consequence, the observer may be assessed as well as the images he or she interprets. Requirements exist in certain non-medical professions where vision is considered important, for periodic VA and contrast sen- sitivity testings. Pilots and flight engineers, for example, are subject by the Civil Aviation Authority to comply with specific visual standards at the onset of their career, and to undergo annual testing (see Table 3) [9].

In our survey 71 % of respondents felt that regular monitoring of VA should be required, and only 18 % of surveyed radiologists were opposed to the concept of periodic testing. This would suggest that attitudes among radiologists would not necessarily be a barrier to the implementation of mandatory VA and contrast sensitivity testing at the onset of and periodically during their careers. The main concerns raised related to the actual testing process and the experience of the occupa- tional health department to provide this.

It may be that individual radiologists should organise their own tests with an optometrist of their choice, and let their employers bear the cost. After all, 74 % of our respondents had had contact with an optometrist al- ready and could presumably be followed up by that per- son.

The introduction of the 1992 Health and Safety Guidelines [10] on minimum safety and health require- ments for work with display screen equipment becamea statute within member states of the European Unionin December 1992. Employers have had to assume cer- tain obligations including entitling workers to an appro- priate eye test before commencing and at regular inter- vals during their employment [11]. It would be

logical to allow extension of these guidelines to those workers exposed to ionising radiation, or to explore the possibil- ity of implementing new guidelines related to this. Mostof the radiologists in our survey who were aware of the existence of current guidelines for display screen work- ers felt that they were of relevance to our profession. Such guidelines are likely to assume increasing impor- tance as we move into the next century, and direct re- porting of digital images from VDU workstations be- comes the norm. It would not be unreasonable to exam- ine the VA of radiologists at the start of and during their practising career. Much effort is expended into improv- ing image quality and resolution, training and interpre- tation skills, and there is sufficient evidence available to show a link between VA and detection of lesions to make this exercise worthwhile. It will become more rel- evant with increasing litigation, and any move to regular testing, if deemed necessary, would be better instigatedby the profession itself. Employers should bear the cost of this exercise, and there may then also be a possibility of obtaining medical insurance to cover a radiologist against potential loss of career or earnings as a result of loss of vision or accelerated deterioration of VA.

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