VOLUME - 11, ISSUE - 01, JANUARY - 2022 • PRINT ISSN No. 2277 - 8160 • DOI : 10.36106/gjra

Original Research Paper

Radiodiagnosis

NON-RADIATION RISK IN RADIOLOGISTS AND ERGONOMICS- RELEVANCE IN CURRENT RADIOLOGY.

Dr Renu Yadav* MBBS ,MD, Department of Radiodiagnosis, VMMC & SJH, New Delhi. India. *Corresponding Author

Dr. Anuradha Sharma MD, Associate Professor. Department Of Radiodiagnosis, VMMC & Safdarjung Hospital. New Delhi. India.

ABSTRACT Radiologists and other health care staff in radiology department are constantly being exposed to both radiation and non-radiation risks. Radiation related health risks have received their due attention and efforts are constantly being taken up to minimize risks. Significant transition from film based to filmless imaging has resulted in increased human to machine interaction adding non-radiation hazards in addition to the already existing radiation risks. Non-radiation risks like musculoskeletal symptoms, chronic eye strain, transducer user syndrome have received little attention, despite enough evidences in literature. They can considerably impact physical and mental health, thereby decreasing productivity, efficiency, increasing work errors, fatigue and early burnout. Ergonomics the scientific study of working population in their environment and with its three pronged approach; workstation design, management responsibilities and training and education of employees can significantly decreases fatigue by approximately 70- 80% and increases work force output.

KEYWORDS :

INTRODUCTION

Radiologist plays a central role in current health team. Radiology departments have undergone significant change in the past. Film based radiology has been replaced by filmless radiology. Picture Archiving and Communication Systems (PACS) workstations is the new norm replacing existing the film-based images and viewing boxes. Monitor, keyboard, mouse, printer, speech recognition software, workstation table, chair form integral part of radiologist's work station with significant human–machine interactions. All changes have led to improved workflow, increased productivity and diagnostic accuracy, but have brought along their inherent deleterious effects.[1,2,3] Increased interaction with monitors, prolonged single upper limb use while doing ultrasound, wear heavy lead apron for prolonged hours which have brought into the picture repetitive stress injuries(RSI) like musculoskeletal or chronic eye strain.[4]

Radiation risk in radiology department workforce have received a good deal of attention in the past; numerous efforts have been taken and still are being taken to minimize risks and maximize benefits. Non-radiation risks have received little attention as radiologists work in singular environment and their job is considered less physically demanding compared to clinicians. Kumar et al. reported backache in 83% of technologists and neck pain in 59% of female radiologists.[5] Another study by Kawthalkar, et al. observed significant number of radiologists have RSI with neck pain being the commonest (52%). Significant correlation was found between number of USG examinations performed per day, prevalence of neck pain, low back pain, and shoulder pain. Symptoms of digital eye strain or computer vision syndrome (CVS) were observed in 57 % of radiologists, 45% radiologists had no knowledge about science of ergonomics.[6] Constant single upper limb use for performing ultrasounds causes predisposes to musculoskeletal strain in upper limb, carpal tunnel syndrome, carpal instability, tendinitis, eye strain, neck, back , shoulder and upper extremity pain complex comprises transducer user syndrome.[7] Association has been found between prolonged mouse or keyboard usage and development of carpal and cubital tunnel syndrome.[8]

Above stated literature presents enough evidences for non-radiation risks in radiologists, necessitating need for incorporating ergonomics in work culture.

Now here comes the role of Ergonomics, term derived from the Greek words ergon (labour, work)and nomos (law, rule); which means rules at work.[9] Rather than forcing working population to adapt to the environment, ergonomics modifies workplace and equipment designs in scientific manner to make it best suited to radiologists, thereby increasing human efficiency, reducing fatigue and discomfort. Ergonomics employ three pronged approach. The first is engineering or workstation design. Second is management responsibilities. Third prong involves training and education of employees.

Workstation Design/engineering-

Monitors- Monitors employed are either cathode ray tube (CRT) or liquid crystal display (LCD); both come with their inherent advantages or disadvantages. LCD monitors are compact, lightweight, emit less harmful radiation, but has narrow viewing angle; whereas CRT screen has very wide angle, consumes less energy, and requires more space. Three-monitors out of which two high resolution monitors for viewing and reporting images; and one optimal for checking worklist is the most acceptable configuration for most workstation. Position of chair, table, keyboard, and monitors used at the workstation should be such that everything needed by radiologist within easy reach to maximize comfort and efficiency.

Workstation Table- Height of table and seat should be adjustable to accommodate requirements of number of users, common to every radiology department and should allow comfortable working in sitting or standing position. Frequent changing between seating or standing position prevents RSI. Radiologist should sit approximately 50-75cm away from monitor[10] or an arm length. Radiologist' eyes should be at the level of upper 1/3rd of monitor[11] not higher or lower than that it causes neck pain, increased eyestrain and fatigue Neck pain is less when gaze is slightly downwards at an angle of 14°or more.[12] Improper seating causes repetitive neck twisting and undue muscle strain. Few minutes dedicated to adjusting chair and table before resuming work can go a long way in reducing RSI.

Lighting– should be indirect and glare free. The relative balance between monitor light output and ambient lighting is important to reduce eye fatigue, improving efficiency and accuracy.[13] Sub or supra-optimal ambient lighting increases interpretation times, fatigue, and decreased accuracy. Lighting needs to accommodate multiple requirements like viewing desktop papers, image

interpretation, seeing people across the room, and ensuring that people can walk safely and to avoid interference between different needs, there should be fine tuning of lighting appliances. Blinds and shades are used to control outside light; and walls are painted dark to decrease glare. Ideal range of light intensity for radiology view boxes is 1500 to 3000 candelas.[14] Sub-optimal illumination employs more of rods compared to cones decreasing visual acuity and visual fatigue.

Acoustic- Computer workstation, printer, keyboard, mouse, fan, human interaction all comprises of ambient sound. There should be optimal sound level, it should not be either too quite or loud, as in utmost calm human voice can cause significant distraction. With the advent of voice recognition ambient noise level can affect its accuracy.[13] Noise is unwanted sound, affects concentration thereby decreasing productivity. In shared reading rooms common to large hospitals, interference from surroundings produces noisy, distracting atmosphere. Combination of proper dividing panels, sound absorbing devices should be utilized

Temperature And Ventilation- Workstation computers, printers, CPU all emit heat and raise the workplace temperature. Comfortable temperature ranges between 20 and 24° C, whereas relative humidity between 40 and 60%.[1] While changing from film based radiology to filmless radiology, optimal capacity air-conditioning system should be included at the planning stage of PACS reading room to accommodate heat emitted from appliances.

Management Responsibilities And Preventive Measures-
Pre-employment screening and periodic medical check-up with maintenance of health card.

Training regarding preventive measures before induction into service and their and regular reinforcement.

Rotation between the different duties.

Early detection of signs and symptoms of illness and taking proper medical help and remedial measures to protect other workforce.

Posters, charts displaying training material, alert signs and symptoms at various places in the institutions.

Forming occupational health team to assist departmental design according to ergonomics, health screening with proper medical assistance and imparting regular training to the workforce.

Providing light weight lead free apron made up of tin, antimony or tungsten instead of heavy lead apron as interventional radiologists require them to wear for prolonged hours can causes musculoskeletal problems in addition to being environmental hazard. However lead free aprons have demonstrated different attenuation lead equivalence varying with energy. Hence require acceptance testing before mass usage.[14]

Training And Education-
Importance of training cannot be over-emphasized as knowledge is power. Only if one knows about ergonomics will one be able to implement things in routine practice. This will significantly reduce risk of RSI. Small work breaks every 30-60 minutes greatly reduces risk for work-related discomfort. Switching between standing and sitting position and standing for periods during the day beneficial for improving circulation, energy levels, and productivity.

Personal Factors- The neck should be in a neutral position while looking at the monitor. The upper arms should be relaxed by the side, with the elbows as close to body as possible. Forearms should be horizontal and right angles to the arms. Elbow rests are helpful for maintaining posture. Problems arise from sitting with bad posture or with inadequate backrests.

To combat transducer user syndrome dictation devices or hands free devices should be adopted, and roller mice and left hand devices need to explored to prevent RSIs to one hand.

Vision- Computer vision syndrome or digital eye strain is described as group of eye and vision-related problems resulting from prolonged computer/mobile phone use. Viewing a monitor screen at a close distance requires accommodation, convergence, and miosis causing visual fatigue. Symptoms include dry eyes, irritation.

Measures required to minimize CVS are-
Ensuring adequate hydration. Reading a mix of studies or modalities with break between academic work, in the form of time taken for administrative work, academic discussion with colleagues or interaction with patients in the procedure room.

Avoid dry eyes and wearing eyeglasses instead of contact lenses. Maintaining optimal humidity at workplace.

Minimize use of other digital devices outside of work.

Anshel et al suggested rule of 20-20-20, implying looking at object 20feet away every 20 minutes for 20 seconds.[15]

CONCLUSION-

Radiology departments have evolved significantly in the past from film based to filmless imaging generating new set of non-radiation hazards in addition to radiation risks already existing. Ergonomics is the need of the hour to optimize productivity with least health risks. Optimal design will reduce risk of RSIs. Best practice include task variation, alternating between sitting and standing, looking 20ft away for 20 sec every 20 min can go long way.

REFERENCES

1. Harisinghani MG, Blake MA, Saksena M, Hahn PF, Gervais D, Zalis et al. Importance and effects of altered workplace ergonomics in modern radiology Suites. RadioGraphics. 2004; 24(2):615–627.
2. Reiner BI, Siegel EL, Hooper FJ, Pomerantz S, Dahlke A, Rallis D. Radiologists' productivity in the interpretation of CT scans: A comparison of PACS with conventional film. AJR Am J Roentgenol 2001;176:861
3. Mehta A, Dreyer K, Boland G, Frank M. Do picture archiving and communication systems improve report turnaround times. J Digit Imaging 2000;13:105-107.
4. Halpenny D, O'Driscoll D, Torreggiani WC. Ocular health among radiologists in the age of PACS: Is it time for our profession to open its eyes to this issue in light of existing European legislation. Br JRadiol 2012;85:1309-1311.
5. Kumar S, Moro L, Narayan Y. Perceived physical stress at work and musculoskeletal discomfort in x-ray technologists. Ergonomics 2004;47:189-201.
6. Kawthalkar AS, Sequeira RA, Arya S, Baheti AD. Non-radiation occupational hazards and health issues faced by radiologists – A cross-sectional study of Indian radiologists. Indian J Radiol Imaging 2019;29:61-66.
7. Schoenfeld A, Goverman J, Weiss DM, Meizner I. Transducer user syndrome: an occupational hazard of the ultrasonographer. Eur J Ultrasound 1999;10(1):41-45.
8. Ruess L, O'Connor SC, Cho KH, Hussain FH, Howard WJ, Slaughter RC et al. Carpal tunnel syndrome and cubital tunnel syndrome: work-related musculoskeletal disorders in four symptomatic radiologists. AJR Am J Roentgenol 2003;181(1):37-42.
9. N. Goyal, N. Jain, V. Rachapalli. Ergonomics in radiology. Clinical Radiology (2009) 64, 119-126.
10. Siegel E, Reiner B, Abiri M, Chacko A, Morin R, Ro DW et al. The filmless radiology reading room: a survey of established picture archiving and communication system sites. J Digit Imaging 2000;13:22-23
11. Prabhu SP, Gandhi S, Goddard PR. Ergonomics of digital imaging. Br J Radiol 2005;78:582-6.
12. Izquierdo JC, Garcia M, Buxo C, Izquierdo NJ. Factors leading to the Computer Vision Syndrome: an issue at the contemporary workplace. Bol Asoc Med P R 2004;96:103-110.
13. Siegel E, Reiner B, Abiri M, Chacko A, Morin R, Ro DW et al. The filmless radiology reading room: a survey of established picture archiving and communication system sites. J Digit Imaging 2000;13:22-3.
14. Mansour Tayebi, Fatemeh Shekoohi Shooli, Mahdi Saeedi-Moghadam. Evaluation of the scattered radiations of lead and lead-free aprons in diagnostic radiology by MCNPX.Technol health care 2017;25(3):513-520
15. Jeffrey A, editor. Visual ergonomics handbook. New York: Taylor & Francis; 2005.