

Prevalence of Non-Radiation Health Hazards Among Radiologists and Correlation with Demographic and Occupational Factors- An Observational Study

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Abstract

Background: The aim is to assess the prevalence of non-radiation health hazards among radiologists and to assess the correlation with demographic and occupational risk factors. **Settings and Design:** Cross-sectional observational study. **Subjects and Methods:** Fifty radiologists were included in the study. A questionnaire was given to these radiologists and information was collected. Responses were statistically analysed and chi-square test was used to test significance of correlation ($P < 0.05$). **Results:** In our study, there was high prevalence (44%) of non-radiation occupational hazards among radiologists with significant correlation with increased workload, female sex, poor body posture, reduced physical activity and lack of knowledge about ergonomics. **Conclusion:** The present study shows that the prevalence of non-radiation hazards is high among the radiologists and increased workload, repetitive movements, lack of physical exercise and poor ergonomics pose a risk for development of these occupational hazards in radiology profession. Reducing workload, adopting correct posture, taking frequent breaks, regular physical exercise and using ergonomically designed equipment and work stations would be useful in prevention of such hazards.

Keywords: Non-Radiation Occupation Hazards, Posture, Shoulder Pain., ergonomics

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Introduction

Radiology is the backbone of modern clinical medicine. There is significant increase in the workload of radiologists in present times due to the modern clinical practice of evidence-based medicine and due to advent of new advanced imaging techniques. In addition to the radiation hazards, the radiologists are facing significant non-radiation occupational health hazards due to demanding schedules and work pressures. These hazards are quite common and have great impact on physical and mental being of radiologists.^[1] These hazards include musculoskeletal repetitive stress injuries, neck pain, back pain, chronic eye strain, mental stress, depression, etc. The increase in the number and duration of scans per day is a risk factor for developing musculoskeletal disorders of the upper extremity. Most of the radiologists spend maximum hours in performing ultrasound (USG), hold the transducer for a long time and do dynamic repetitive movements to manipulate the transducers. Because of repetitive movements, they are prone to have

'Transducer user syndrome'.^[2] Armstrong et al. (1984) concluded that repetitive forceful movements, extreme anatomical changes, static muscles and awkward positions in sonography are important causative factors of upper limb musculoskeletal disorders, and this condition was named as 'transducer user syndrome' by Degani and Solomon (1997). Other advanced diagnostic modalities such as CT scan and MRI, which demand prolonged sitting position and work on computers/picture archiving and communication system (PACS), have increased the burden on radiologists.^[3] Moreover, there is lack of awareness among the radiologists about factors causing these hazards and role of ergonomics in prevention of these hazards. Due to these hazards, there is adverse impact on the physical and mental well-being of the radiologists, the efficacy, productivity and overall work satisfaction of radiologists has decreased and chances of medical errors have increased significantly.^[4]

In the present study, the aim is to find out prevalence of non-radiation occupational hazards among radiologists and to

assess how these correlate to demographic factors such as age, gender, physical activity and to occupational factors like work load, ergonomics and other working conditions.

Subjects and Methods

After approval from institutional ethical clearance committee, a cross-sectional observational study was conducted using a questionnaire. Fifty radiologists were included in the study. Questions were asked on age, gender, predominantly film reporting/workstation reporting/USG, work load- like number of years worked as radiologist, working days per week, working hours per day, number of scans per day, number of hours working on computers/workstation/PACS, repetitive forceful wrist motions, hand grip pressures, scanning positions like shoulder abduction, overreaching, twisted neck and back and prolonged sitting position. Questions on musculoskeletal repetitive stress injuries included pain in the shoulder/neck/ back/extremities, nature of pain (constant, intermittent), tingling/ numbness in the extremity, weakness in extremity, motion restriction in the neck/shoulder/ back/extremity, and difficulty performing the task as a result of such symptoms. Questions were also asked on presence of headache, blurring of vision, dryness of eyes (chronic eye strain), mental stress/depression, physical activity/ exercise(number of days exercised for 30 min or more) and ergonomics including knowledge and application of ergonomics. Responses were statistically analysed to evaluate correlation of various parameters. The level of significance was checked with chi-square test having p-value 0.05.

Results

Of the 50 participants, 29 (58%) were males and 21(42%) were females. Male to female ratio was 1.38:1. 36% (18/50) were in the age group <40 years, 42% (21/50) were in the age group of 41-50 years, 10% (5/50) were in age group 51-60 years and 12% (6/50) were in age group >60 years. The mean age in our study was 44.3 years.

70% radiologists had worked between 5 to 20 years and 92% radiologists practiced only diagnostic radiology. The working pattern was workstation-based in 48% (24/50), film-based in 8%(4/50) and USG-only in 44%(22/50). Most radiologists (84%) worked for 5 or more days per week for six or more hours per day. 74% radiologists (37/50) were working for 30-60 hours/week. There was significant correlation between increasing workload and the prevalence of musculoskeletal repetitive stress injuries (P < 0.05). 44% (22/50) radiologists reported symptoms of repetitive stress injuries at some point of time after starting their radiology career. 6 (12%) radiologists had missed work because of their symptoms, two (4%) suffered carpal tunnel syndrome and

one (2%) was diagnosed with cubital tunnel syndrome. The symptoms were significantly more common among female radiologists (P<0.05). Wrist pain and neck pain were the most common symptoms (95% and 86% respectively) among the radiologists who suffered with musculoskeletal repetitive stress injuries. The symptoms were positively correlated with repetitive twisting and forceful wrist movements, high grip pressure and twisted body posture. Out of all the radiologists who suffered with repetitive stress symptoms, only 30% had received medication and/or physiotherapy. Out of all the radiologists, 66% (33/50) suffered from chronic eye strain and 32% (16/50) suffered from mental stress/ depression at some point of time in their radiology careers. 78% radiologists did not exercise regularly and 54% (27/50) radiologists were not aware of ergonomics and its application.

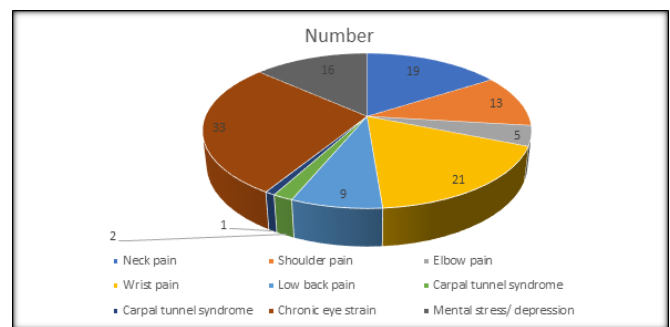
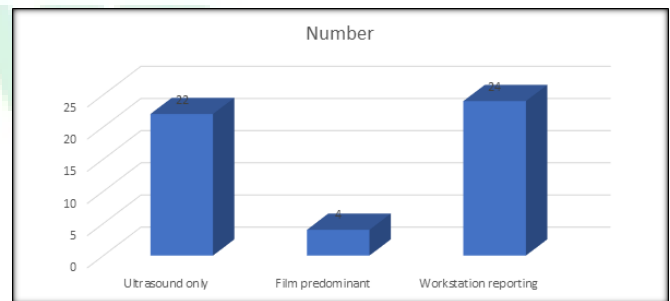
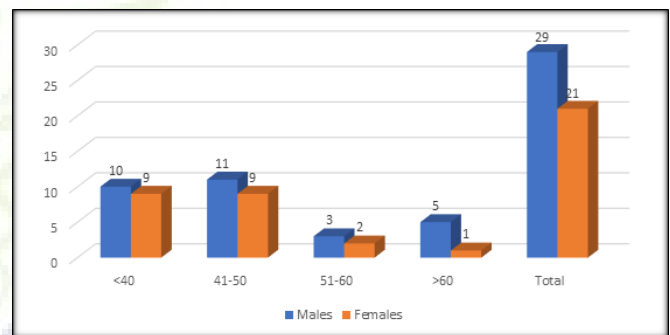


Table 1: Age and gender distribution

Age group (years)	Males	Females
<40	10	9
41-50	11	9
51-60	3	2
>60	5	1
Total	29	21

Table 2: Work patterns of Radiologists

Work patterns	Number	Percentage
Ultrasound only	22	44%
Film predominant	4	8%
Workstation reporting	24	48%

Table 3: Number of working hours per week

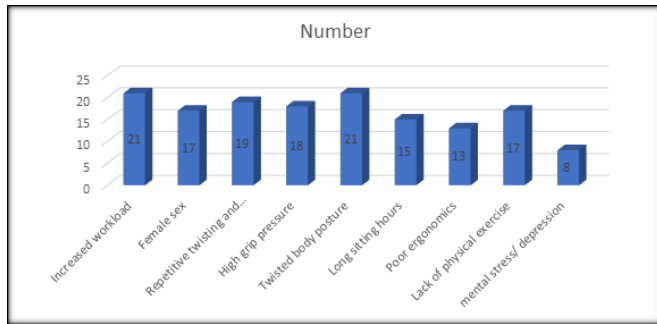
Working hours/week	Number	Percentage
<30	8	16%
30-60	37	74%
>60	5	10%

Table 4: Non- radiation occupational hazards

Occupational hazards	Number	Percentage
Neck pain	19	38%
Shoulder pain	13	26%
Elbow pain	5	10%
Wrist pain	21	42%
Low back pain	9	18%
Carpal tunnel syndrome	2	4%
Carpal tunnel syndrome	1	2%
Chronic eye strain	33	66%
Mental stress/ depression	16	32%

Table 5: Correlation of repetitive musculoskeletal stressinjuries with demographic and occupational factors

Risk factors	Number	Percentage	P value
Increased workload	21	95.5%	<0.05
Female sex	17	77.3%	
Repetitive twisting and forceful wrist movements	19	86.4%	
High grip pressure	18	81.8%	
Twisted body posture	21	95.5%	
Long sitting hours	15	68.2%	
Poor ergonomics	13	59.1%	
Lack of physical exercise	17	77.3%	
mental stress/ depression	8	36.4%	



Discussion

Due to increase in number of patients, emergence of new diseases, evidence-based medical practice and advent of advanced imaging modalities, there is tremendous increase in the demand and subsequently, the workload on radiologists has increased significantly.^[5,6] This has also increased the risk of radiation hazards as well as non-radiation occupational hazards among radiologists. In our study, we assessed the prevalence of non- radiation occupational hazards among a sample of fifty radiologists. The prevalence of musculoskeletal injuries among radiologists in our study was as follows – neck pain 38%, low back pain 18 % and repetitive stress injury 44%. Kawthalkar et al, evaluated health issues faced by 383 radiologists in a study in 2019 and found that the prevalence of neck pain was 52%, low back pain was 45% and repetitive stress injuries for upper limb was 78%.^[7] A high prevalence of repetitive stress injuries, chronic eye strain, depression, and burnout was found. Various studies have also revealed that there is significant correlation between repetitive stress injuries and burnout.^[7] Our study also found significant correlation between increasing workload and prevalence of musculoskeletal repetitive strain injuries among radiologists, with 95.5% of injured radiologists reporting excessive workload as contributing factor.

Various studies indicate high prevalence of chronic eye strain ranging from 68% to 76% among computer professionals.^[7] Our study also showed a prevalence of 66% for eye strain among radiologists. In our study, 32% of radiologists reported mental stress or depression at some point in their careers. Literature also shows that approximately 13%–20% of physicians are known to suffer from depression.^[1] A high correlation was also found in our study between mental stress/depression and musculoskeletal repetitive strain injuries, with 36.4% of injured radiologists reporting mental stress/depression due to their injuries.

Significantly high number of radiologists (54%) in our study, were not aware about role of ergonomics in prevention of these hazards. Various studies had revealed that the radiologists whose practices followed ergonomic design

showed significantly less prevalence of these injuries^[7] The literature also suggests that ergonomic factors, equipment design and specific work techniques are associated with carpal tunnel syndrome and other work-related disorders and the twisting and pushing motions correlate positively with symptoms of carpal tunnel syndrome.^[2] The term ‘computer back or neck syndrome’ is used for muscular-skeletal disorders in radiologists. The prolonged inaccurate posture like hunching of back while reporting, long hours of sitting without breaks, poor ergonomics and lack of exercise and stretching etc., contribute to these symptoms. Small and multiple breaks are needed for prevention, with some relaxing and stretching exercises.^[8] Height adjustable chairs and computer monitors are needed at CT/MRI work stations; height adjustable and ergonomically designed couches, chairs and USG machines are needed in the ultrasound department to prevent repetitive stress injuries in radiologists.

In our study, we also found that symptoms were more common among female radiologists. Literature shows that due to significant differences with respect to muscle bulk and muscle strength between men and women, male radiologists suffer lesser combined symptoms compared to the female radiologists.^[2] Also, due to differences in the body heights of radiologists, more twisted body postures are adopted by the shorter radiologists to reach or overreach the patient, keeping the shoulder and arm in large angles of abduction for long times, especially when the USG couch is not height-adjustable and the patient is obese. This might also explain why the occurrence of musculoskeletal repetitive stress injuries are more common in female radiologists. Therefore, there is an urgent need to design ergonomic workstations and ultrasound equipment, adjustable ultrasound couches and flexible hardware to suit various user requirements in order to prevent such disabling injuries. With the advent of voice recognition systems for dictating radiology reports, there is now reduction in usage of mouse and keyboards in the departments using such systems. Similarly, a suitable and correct height of radiologist chair, screen of computer and reporting desk is recommended. The light system of room and appropriate brightness is also desirable.^[9]

Reducing the number of scans, small breaks between the scans, using height adjustable ultrasound couches, using ergonomic work stations, adopting good body posture and regular physical exercises would be useful in prevention of such hazards in radiologists

Conclusion

Our study concludes that the prevalence of non-radiation occupational hazards is high among the radiologists. Most radiologists are suffering with these hazards at some point of time in their career. Increased workload, repetitive and forceful

movements, poor body posture, lack of physical exercise and poor ergonomics are the risk factors for development of these occupational hazards in radiology profession. There is a need to increase the awareness about these issues and also to adopt all possible preventive measures in order to reduce the occurrence of these non-radiation occupational hazards among the radiology professionals.

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