Work-Related Musculoskeletal Disorders among Radiologists in Isfahan: A Cross-Sectional Study

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Abstract: Work Related Musculoskeletal Disorders (WRSDs) are a common health problem and a major cause of disability. The aim of this study is to determine 12 months prevalence of musculoskeletal symptoms among radiologists and determine the relationship of ultrasonography practice posture and workload factors with those symptoms. About 23 (48.9%) of them were male and 24 (51.1%) were female. The mean age, total work hours per week and ultrasonography practice hours per week were 38.6 ± 13.5, 29.9 ± 12.2 and 23.3 ± 9.6, respectively. Generally, report of anatomical regions pain was higher in man compared with women that it was significant (p = 0.05). There were not statically significant relation between anatomical regions pain and cases groups (p = 0.06). There were no significant relation between anatomical regions pain and ultrasonography practice hours (p = 0.4) and total working hours (p = 0.8). There were significant relation between total pain risk status and sex (p = 0.03), total working hours (p = 0.01) and age groups (p = 0.02). Also, there were significant relation between risk status of shoulder pain and age groups (0.002). There were significant relation between risk status of wrist pain and sex (0.04). WRSDs onset reported as a gradually, suddenly and known accident in 59.3, 31.7 and 10%, respectively. These findings suggest that the 6 months, prevalence of WRSDs among radiologists in Isfahan is not similar to prevalence reported in other study with values lower than their values. Also, there was no significant relation between anatomical regions pain and most of risk factors. We recommend performing further studies with more cases on radiologists.

Key words: Musculoskeletal disorders, radiologists, quik exposure check, accidents, symptoms, Iran

INTRODUCTION

Work Related Musculoskeletal Disorders (WRSDs) are a common health problem and a major cause of disability (Bernard, 1997). In the work place, the health care professionals are vulnerable to sustaining musculoskeletal disorders during the course of their work routine (Russo *et al.*, 2002; Alexopoulos *et al.*, 2004).

Kao *et al.* (2009) defined WRMDs among medical staff in radiology staff as musculoskeletal injuries that result from a work related events. Radiologists are one of the members of medical staff in radiology department, suffer from musculoskeletal symptoms secondary to performing ultrasonography.

The aim of this study is to determine 12 months prevalence of musculoskeletal symptoms among radiologists and determine the relationship of ultrasonography practice posture and workload factors with those symptoms.

MATERIALS AND METHODS

In a cross sectional study, radiologists list in Isfahan determined by using Medical Council Information Center. Among all of radiologists, 47 cases registered to the study. We went to their workplace (hospital, clinic or office) and took a photograph, using digital camera during performing ultrasonography. Then photographs data analyzed using Quick Exposure Check (QEC) for assessing exposure to risk factors for WRSDs.

In a cross sectional study, radiologists list in Isfahan determined by using Medical Council information center. Among all of radiologists, 47 cases registered to the study. Moreover, 24 radiology residency students (with the exception of juniors) registered to the study. Therefore, a total of 47 cases entered to the study. A questionnaire was used for sociodemographic information including age, sex, duration of total work per week, duration of ultrasonography practice per week and musculoskeletal complaints depending on anatomicalz

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regions (lower back, neck, shoulder, arm, elbow, forearm and wrist). We went to their workplace (hospital, clinic or office) and took a photograph using digital camera during performing ultrasonography.

Then photographs data analyzed using Quick Exposure Check (QEC) for assessing exposure to risk factors for WRSDs. Cases were asked whether they had experienced WRSDs that we defined as discomfort or pain secondary to their work and lasting >2 days in the last 6 months in any part of body. Then subjects who mentioned experience of WRSDs symptoms in any of body regions were asked to choose, the regions of disorder that they considered as the most significant and asked further questions about their disorder. According to the total working hours per week, all cases categorized in two groups as follow:

- Low total working hours (≤ 25 h)
- High total working hours (>25 h)

Depending on ultrasonography performing hours per week, all subjects categorized in 3 groups as follow:

- Low working hours (≤14 h)
- Moderate working hours (15-29 h)
- High working hours (≥30 h)

Also, depending on exposure percentage, all subjects categorized in no, low, moderate and high risk status; risk levels calculated by QEC software. The study was approved by Medical Ethical Committee of Isfahan Medical University. Collected data were subjected to statistical analysis using SPSS software. The results were given as mean (SD) values.

Paired t-test and Pearson chi-square (χ^2) test were used to compare the differences between mean values of two paired variables for normally and none normally distributed date. The level $p = 0.05$ was considered as the cut-off value for significant.

RESULTS AND DISCUSSION

Among a total of 47 radiologists and radiology residency students, women and men accounted for 23 (48.9%) and 24 (51.1%) of sample population, respectively. The mean age (in years of old), total work hours per week and ultrasonography practice hours per week were 38.6±13.5 (32.6±11.6 for women and 44.3±12.8 for man), 29.9±12.2 (26.7±11.7 for women and 33.0±12.0 for man) and 23.3±9.6 (24.1±12.3 for women and 22.6±6.1 for man), respectively. Also, the mean age (in years of old), total work hours per week and ultrasonography practice hours per week were 47.7±10.7, 35.2±11.6 and 26.0±10.3 for radiologists, respectively; there were 29.8±9.6, 24.8±10.6 and 20.8±8.3 for residency students, respectively. All of participants reported that they had experienced work related musculoskeletal pain or discomfort at some time in their occupational lives.

Table 1 shows that the 6 months prevalence rates of WRSDs were highest in the lower back (34.0%) but least in the wrist (6.4%). Of all affected cases, no one reported that they had sought treatment from other health practitioners for WRSDs. Table 1 also shows the association between 6 months prevalence of WRSDs and age, sex and working hours (total and ultrasonography practice) among all affected cases. Individual anatomical prevalence rate was higher in the cases who were >40 years old compared with <40 years old but it was not significant ($p = 0.3$).

Generally, report of anatomical regions pain was higher in man compared with women that it was significant ($p = 0.05$). There were not statically significant relation between anatomical regions pain and cases groups ($p = 0.06$).

There were no significant relation between anatomical regions pain and ultrasonography practice hours ($p = 0.4$) and total working hours ($p = 0.8$). Table 2 shows relation between risk status of anatomical regions and case groups, sex, working hours (total and ultrasonography) and age groups.

Table 1: Association between 6 months prevalence of WRSDs and age, sex and working hours (total and ultrasonography)

Pain sites	Groups		Sex		Ultrasonography working hours			Total working hours		Ages groups	
	Resident	Professor	Man	Female	≥14	15-29	≥30	Low ≤25	High >25	≤40	>40
Neck	8.50	4.30	8.5	4.3	0.0	10.6	2.1	8.5	4.3	4.3	8.5
Lower back	25.50	8.50	10.6	23.4	4.3	19.1	10.6	21.3	12.8	8.5	25.5
Arm	0.00	12.80	2.1	10.6	0.0	6.4	6.4	6.4	6.4	0.0	12.8
Elbow	4.30	8.50	10.6	2.1	0.0	10.6	2.1	4.3	8.5	0.0	12.8
Forearm	4.30	6.40	8.5	2.1	2.1	8.5	0.0	4.3	6.4	2.1	8.5
Leg	4.30	6.40	8.5	2.1	0.0	10.6	0.0	6.4	4.3	0.0	10.6
Wrist	4.30	2.10	2.1	4.3	0.0	6.4	0.0	4.3	2.1	0.0	6.4
Total	51.10	48.90	51.1	48.9	6.4	72.3	21.3	55.3	44.7	14.9	85.1
p value	0.06	-	0.05	-	0.4	-	-	0.8	-	0.3	-

Table 2: Relation between exposure risk and age, sex and working hours (total and ultrasonography)

Pain sites	Risk status	Groups			Sex			Total working hours			Ages groups			Ultrasonography working hours			
		Resident	Professor	p value	Man	Female	p value	Low	High	p value	≤40	>40	p value	>14	15-30	>30	p value
Lower back	With no risk	29.8	31.9	0.60	36.2	25.5	0.10	29.8	31.9	0.20	6.4	55.3	0.400	4.3	42.6	14.9	0.8
	With low risk	21.3	17.0		14.9	23.4		25.5	12.8		8.5	29.8		2.1	29.8	6.4	
Shoulder	With low risk	42.6	46.8	0.07	46.8	42.6	0.90	46.8	42.6	0.09	8.5	80.9	0.002	4.3	66.0	19.1	0.1
	With moderate risk	8.5	0.0		2.1	6.4		8.5	0.0		6.4	2.1		2.1	6.4	.0	
	With high risk	0.0	2.1		2.1	0.0		0.0	2.1		0.0	2.1		0.0	0.0	2.1	
Wrist	With no risk	2.1	4.3	0.1	6.4	0.0	0.04	4.3	2.1	0.90	0.0	6.4	0.600	0.0	4.3	2.1	0.7
	With low risk	44.7	29.8		40.4	34.0		40.4	34.0		10.6	63.8		4.3	57.4	12.8	
	With moderate risk	4.3	14.9		4.3	14.9		10.6	8.5		4.3	14.9		2.1	10.6	6.4	
Neck	With no risk	0.0	4.3	0.2	4.3	0.0	0.40	2.1	2.1	0.30	0.0	4.3	0.800	0.0	2.1	2.1	0.4
	With low risk	10.6	8.5		10.6	8.5		8.5	10.6		2.1	17.0		2.1	14.9	2.1	
	With moderate risk	25.5	29.8		27.7	27.7		27.7	27.7		8.5	46.8		2.1	36.2	17.0	
	With high risk	14.9	6.4		8.5	12.8		17.0	4.3		4.3	17.0		2.1	19.1	0.0	
Total pain	With no risk	2.1	2.1	0.2	4.3	0.0	0.03	4.3	0.0	0.01	0.0	4.3	0.080	0.0	4.3	0.0	0.5
	With low risk	19.1	29.8		31.9	17.0		17.0	31.9		2.1	46.8		2.1	31.9	14.9	
	With moderate risk	29.8	17.0		14.9	31.9		34.0	12.8		12.8	34.0		4.3	36.2	6.4	

There were significant relation between total pain risk status and sex (p = 0.03), total working hours (p = 0.01) and age groups (p = 0.02). Also there were significant relation between risk status of shoulder pain and age groups (0.002). There were significant relation between risk status of wrist pain and sex (0.04). WRSDs onset reported as a gradually, suddenly and known accident in 59.3, 31.7 and 10%, respectively.

Studies have shown that WRSDs are particularly common in health care workers who are in direct contact with patients (Holder *et al.*, 1999; Lipscomb *et al.*, 2004). In this study, we used direct technical measurement (Digital camera and QEC software) due to low validity of the questionnaire assessed exposure data (Hansson *et al.*, 2001). We believe this is the 1st study to evaluation of WRSDs among radiologists and radiology residency students performed using QEC tool. In the study, photograph analysis of ultrasonography operators' anatomical regions posture revealed following results:

- **Lower back:** Moderately flexed, twisted or side bent (Fig. 1)
- **Neck:** Occasionally bent or twisted (Fig. 2)
- **Shoulder and arm:** At about chest height (Fig. 3)
- **Wrist:** A deviated or bent position (Fig. 4)

In this cross sectional study, there were high prevalence for lower back pain (34%) and low prevalence for wrist pain (6.4%). In comparison with the study by Hoozemans *et al.* (1998) that revealed the impact of pushing and/or pulling act on back and shoulder complaints, the prevalence is higher than their report for back pain (34% vs. 21%). Conversely, there was a higher prevalence of neck pain in their group compared with the result (41% vs. 12.8%) (Hoozemans *et al.*, 1998). Moreover in a study, performed on medical staff in a radiology

Fig. 1: Back; moderately flexed or twisted or side bent

department, neck pain was significantly higher than the result (61% vs. 12.8%) (Kao *et al.*, 2009). In another study, conducted on hospital nurses, neck pain was higher than the result, too (Smedley *et al.*, 2003). In a study, performed on dentists by Ratzon *et al.* (2000) reported WRSDs manifestations in the last 12 months were significantly localized in the back (55%) and in the neck (38.3%) (Schierhout *et al.*, 1995) their findings were higher than the study. Lower back pain among radiologists in the study may have related to a variety of intrinsic workplace factors. One reason may have been high positional pressure on lower back during performing ultrasonogrphy (Fig. 1). Another factor may have related to no significant movement for a long time during performing ultrasonogrphy. Neck-related WRSDs as well as arm and elbow were the 2nd most frequent
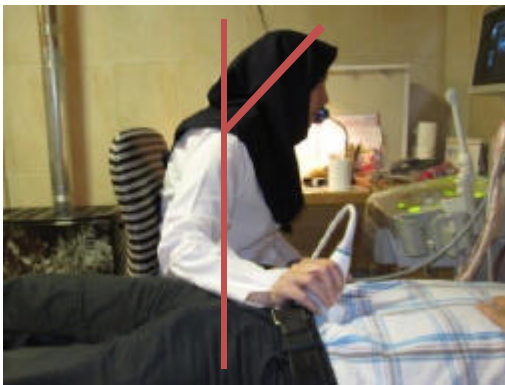
Fig. 2: Neck: occasionally bent or twisted

Fig. 3: Shoulder and arm: at about chest height

Fig. 4: Wrist: a deviated or bent position

(Mirbod *et al.*, 1995). Among Chinese, the prevalence of neck-related WRSDs has previously been reported to be higher among nurses (45%) (Smith *et al.*, 2004) but lower among construction workers (18.4%) (Bao *et al.*, 2000) and general population (15-17%) (Lau *et al.*, 1996).

The low prevalence rate of neck-related WRSDs in the study compared with reported prevalence in similar studies suggests that neck in ultrasonography operators is exposed to low or moderate levels of stress during performing ultrasonography (Fig. 2). Results of studies performed on radiology staff, dentists, nurses as well as results of the study revealed that the most common affected anatomical region among mentioned groups was similar (lower back) despite of different levels of stress on back and despite of exposure to different risk factors.

WRSDs of the shoulder of Chinese physicians (37.8%) (Smith *et al.*, 2006), Chinese nurses (40%) (Smith *et al.*, 2004) and Japanese physicians (17.5-31.5%) (Mirbod *et al.*, 1995) were higher than the study. The relationship between neck/shoulder pain and sitting posture has been examined for workers from seven manufacturing industries in South Africa (Chiang *et al.*, 1993). During ultrasonography, operator spends 5-10 min scanning for a single patient. The repetitive nature of the task may increase the exposure risk. Chiang *et al.* (1993) found that shoulder-girdle (neck, shoulder, upper arm) pain was significantly higher among workers performing tasks with repetitive movements (Jin *et al.*, 2000). In the study, relationship between shoulder exposure risk status and age groups was significant (p = 0.002). We found significant association between wrist exposure risk status and sex (0.04). In Kao *et al.* (2009) and Moeini *et al.* (2008)'s study, also the results for wrist were similar to the study. The radiologists in the study, complained most frequently of lower back pain but there was no significant association between lower back exposure risk status and other risk factors (p>0.05). During ultrasonography, they

complaints, affecting 12.8%. As such their rate was lower than a previous study of subjective complaints among Japanese physicians where it ranged from 20.6-38.9%

spent prolonged periods of sitting and it is appear lower back pain is associated with flexing, twisting or side bending of trunk. In Jin's review of two studies, the incidence of lower back pain among sedentary workers was higher than for workers with free posture (Moeini *et al.*, 2008). Moeini *et al.* (2008)'s study on ophthalmologists' sitting position showed significant association between lower back pain and total working hours (Ratzon *et al.*, 2000). In the study, we found no association between anatomical regions pain including lower back pain and total or echocardiography practice hours (p>0.05).

Also, no significant association was found between time workload and lower back pain in Ratzen study on dentists (Frymoyer and Cats-Baril, 1991). In the study, relationship between only shoulder pain and age groups was significant (p = 0.04).

Studies note an association between WRSDs and age (Runderantz *et al.*, 1990; Adegoke *et al.*, 2008). In Ratzon *et al.* (2000)'s study on dentists, no significant association was found between age and workload. We observed significantly higher prevalence of WRSDs among male radiologists (51.1%) in comparison to females (48.9%) (p = 0.05). In Adegoke *et al.* (2008)'s study on physiotherapists, they observed a significantly higher prevalence of WRSDs among female physiotherapists compared with males. Eventually, it is difficult to make comparisons due to the different measurement methods used and widely varying study population.

CONCLUSION

These findings suggest that the 6 months prevalence of WRSDs among radiologists in Isfahan is not similar to prevalence, reported in other study with values lower than their values. Also, there was no significant relation between anatomical regions pain and most of risk factors. We recommend performing further studies with more cases on radiologists.

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