Musculoskeletal Problems among Surgical Technicians of Shiraz city Hospitals

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Musculoskeletal disorders (MSDs) are a leading cause of occupational injury and disability in developed and industrially developing countries. This study is interested by surgical technicians (STs), since their situation is poorly documented. The studied population is comprised of 375 STs in the city of Shiraz, Iran. Each participant anonymously filled questionnaire based on the Nordic musculoskeletal disorders questionnaire.

The results showed that 85.7% of the participants reported some MSDs symptoms during the past 12 months. Lower back pain (LBP) was the most prevalent problem (60.6%). Among the LBP population 71.8% were female (p-value=0.01). Workplace observations also showed exposure to multiple risk factors, including prolonged standing posture, and manually lifting of surgical sets.

Based on the results, it was concluded that MSDs occurred in high rate in this occupation. Ergonomics evaluations and interventions would be necessary to identified and reduce risk factors such as awkward postures, manual handling of heavy loads and reduction of time of standing work.

1. Introduction

Musculoskeletal disorders (MSDs) represent a leading cause of occupational injury and disability in the developed and industrially developing countries (Shahnazav, 1987), (Kemmlert, 1994), (Smith, 2003), (Menzel, 2004). NIOSH ranks MSDs as a second problem at the list of occupational health problems after pulmonary diseases (i.e., cancer, asthma) (Tayyari, 1997). In many countries prevention of WMSDs has become a national priority (Spielholz, 2001). Based on the statistics released by Iran Social Security Organization, during 1991 to 1994, 14.4% of work-related disability was due to WMSDs (1999). Risk factors of MSDs are known to include workplace activities such as heavy lifting and repetitive task (Bernard, 1997), while demographic characteristics and psychological factors are also known to be important predictive variables (Linton,1989),(Carter,1994),(Weiser,1997). It has been widely accepted that...
awkward and constrained posture result in musculoskeletal stress on different body regions of workers (Li, 1995), and are a major factor in the development of MSDs (Sauter, 1991), (Hochanadel, 1995), (Genaidy, 1994), (Das, 1996), (Li, 1999), (Paquet, 2001).

In medical domain, there have been many studies showing association between WMSDs and workplace factors. For instance, studies have revealed that hospital nurses form an occupational group regularly affected by MSDs (Smith, 2003), (Trinkoff, 2003), (Menzel, 2004), (Choobineh, 2006). Some studies have shown that overexertion injuries might cause health care workers to leave their profession (Owen, 2000), (Choobineh, 2006). Bending, twisting, sudden movement in non-neutral postures and manual handling, in particular patient handling is common job activities in medical centers.

Surgical technicians (STs) or operating room technicians are among those in hospital to be exposed to MSDs risk factors. In this occupation, long hours of standing work together with physical activities such as manual material handling (e.g., heavy load lifting, lowering, carrying, pulling and pushing) and awkward working postures are very common (Figures 1, 2, 3 and 4). In this situation, high rate of WMSDs occurrence are expected (International Occupational Safety and Health Information, 2006).

As far as the researchers know, few ergonomics study has been conducted among ST to determine the prevalence rate of WMSDs and assess exposure to work-related musculoskeletal risks. Therefore, it has been decided to conduct a study in this occupation to determine WMSDs prevalence rate among Iran’s Shiraz hospitals ST. It is believed that the results of this study can be an appropriate base for planning and implementing interventional ergonomics program in the workplace and improving technicians’ health in this occupation.

Figure 1: A surgical technician’s working posture after a long period of standing.
Figure 2: A surgical technicians is carrying a surgical set (4-12 Kg).

Figure 3: A surgical technician is taking a surgical set (4-12 Kg) from high shelves with back, arms and shoulders awkward postures.
1.1. Description of surgical technicians’ tasks

A surgical technician (ST) performs any combination of the following tasks before, during and after surgery to assist surgical team (International Occupational Safety and Health Information, 2006):

1- Places equipment and supplies in operating room and arrange instruments, according to instructions;
2- Assists team members to place and position patient on table; scrubs arms and hands and dons gown and gloves;
3- Maintains supply of fluids, such as plasma, saline, blood, and glucose for use during operation;
4- Hands instruments and supply to surgeon, holds retractors, cut, sutures, and performs other tasks as directed by surgeon during operation;
5- Puts dressing on patient following the surgery;
6- Counts sponge, needle, and instruments before and after operation;
7- Washes and sterilizes equipment, using germicides and sterilizer, cleans operating room.

2. Methods

This cross-sectional study was conducted among 375 STs in Shiraz city hospitals corresponding to nearly 80% of STs employed in Shiraz city hospitals. Data were collected via anonymous questionnaires. The questionnaire consists of two parts and covered the following items: personal details (weight, height, age, gender, job tenure, daily working time, marital status, number of children, health and medical background) and MSDs in different body regions. The general Nordic questionnaire of musculoskeletal symptoms (Kuorinka, 1987) was used to examine reported case of MSDs among the study population. Reported MSDs were limited to the past 12 months. All subjects received the questionnaire in person in their workplace. They had 30 min to complete the questionnaire and return it to the researcher.

Upon completion of the field survey and data collection, data were transferred into the computer for statistical analysis. Statistical analyses are performed using SPSS version 11.5. Chi-square test is used to assess univariate associations between demographic variables and reported musculoskeletal symptoms.

3. Results

Table 1 summarizes personal details of the STs participated in the study. Table 2 presents the prevalence of MSD symptoms in different body regions of the STs during the past 12 months. It is clear that the most commonly affected regions were lower back (60.6%), legs/feet (59%), knees (58.1%) and upper back (54.6%).

The participants’ reports revealed that during the past 12 months there was totally 735 days of sick leave due to MSDs. Accordingly, the average sick leave for each ST was 2.08 days/year (SD = 5.99). Due to MSDs, during the preceding year 38.5% of the study population had to visit a physician, 25.1% had to take sick leave and 18.8% had to use physiotherapy services. 19.5% of them had to quit their job temporarily because of MSDs. 56.6% of STs believed that MSDs would cause them to change their jobs in
future. Significant associations were found between sex and prevalence of MSDs in different parts of the body (shoulders, wrists, back, ankles and feet) (P<0.05). No association was found between age and prevalence of MSDs (Table 3).

Table 1: Some personal details of the STs participated in the study (n=375).

<table>
<thead>
<tr>
<th>Gender (%)</th>
<th>Female</th>
<th>66.4</th>
<th>Male</th>
<th>33.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>M (SD)</td>
<td>31.53 (8.45)</td>
<td>Range</td>
<td>19-62</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>M (SD)</td>
<td>63.09 (11.81)</td>
<td>Range</td>
<td>40-98</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>M (SD)</td>
<td>165.93 (8.48)</td>
<td>Range</td>
<td>140-186</td>
</tr>
<tr>
<td>Body Mass Index</td>
<td>M (SD)</td>
<td>18.95 (3.04)</td>
<td>Range</td>
<td>13.29- 30.25</td>
</tr>
<tr>
<td>Job tenure (years)</td>
<td>M (SD)</td>
<td>8.6 (7.6)</td>
<td>Range</td>
<td>1-35</td>
</tr>
<tr>
<td>Daily working time(hrs)</td>
<td>M (SD)</td>
<td>10.4 (3.0)</td>
<td>Range</td>
<td>4-20</td>
</tr>
<tr>
<td>Monthly working time (hrs)</td>
<td>M (SD)</td>
<td>221.2 (61.42)</td>
<td>Range</td>
<td>60-420</td>
</tr>
<tr>
<td>Marital status (%)</td>
<td></td>
<td></td>
<td>Single</td>
<td>39.3</td>
</tr>
<tr>
<td>Children (%)</td>
<td></td>
<td></td>
<td>Yes</td>
<td>39.2</td>
</tr>
<tr>
<td>Education (%)</td>
<td></td>
<td></td>
<td>Associate diploma</td>
<td>14.2</td>
</tr>
<tr>
<td>Working schedule (%)</td>
<td></td>
<td></td>
<td>Shift</td>
<td>85.5</td>
</tr>
</tbody>
</table>

Table 2: Frequency of reported symptoms in different body regions during the 12 months prior to study (n=375).

<table>
<thead>
<tr>
<th>Body Regions</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck</td>
<td>188</td>
<td>51.9</td>
</tr>
<tr>
<td>Shoulders</td>
<td>187</td>
<td>51.7</td>
</tr>
<tr>
<td>Elbow</td>
<td>83</td>
<td>22.9</td>
</tr>
<tr>
<td>Wrists/Hands</td>
<td>171</td>
<td>47.1</td>
</tr>
<tr>
<td>Upper back</td>
<td>197</td>
<td>54.6</td>
</tr>
<tr>
<td>Lower back</td>
<td>220</td>
<td>60.6</td>
</tr>
<tr>
<td>Hips/Thighs</td>
<td>111</td>
<td>30.7</td>
</tr>
<tr>
<td>Knees</td>
<td>211</td>
<td>58.1</td>
</tr>
<tr>
<td>Ankles/Feet</td>
<td>214</td>
<td>59.0</td>
</tr>
</tbody>
</table>
Table 3: Frequency of reported symptoms in different body regions during the 12 months prior to study, based on sex (n=375).

<table>
<thead>
<tr>
<th>Body Regions</th>
<th>Female No. (%)</th>
<th>Male No. (%)</th>
<th>P-Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck</td>
<td>127(35.1%)</td>
<td>61(16.9%)</td>
<td>0.82</td>
</tr>
<tr>
<td>Shoulders</td>
<td>138(38.1%)</td>
<td>49(13.5%)</td>
<td>0.005</td>
</tr>
<tr>
<td>Elbow</td>
<td>58(16%)</td>
<td>25(6.9%)</td>
<td>0.59</td>
</tr>
<tr>
<td>Wrists/Hands</td>
<td>129(35.5%)</td>
<td>42(11.6%)</td>
<td>0.001</td>
</tr>
<tr>
<td>Upper back</td>
<td>142(39.3%)</td>
<td>55(15.2%)</td>
<td>0.04</td>
</tr>
<tr>
<td>Lower back</td>
<td>158(43.5%)</td>
<td>62(17.1%)</td>
<td>0.01</td>
</tr>
<tr>
<td>Hips/Thighs</td>
<td>80(22.2%)</td>
<td>31(8.6%)</td>
<td>0.18</td>
</tr>
<tr>
<td>Knees</td>
<td>142(39.1%)</td>
<td>69(19%)</td>
<td>0.91</td>
</tr>
<tr>
<td>Ankles/Feet</td>
<td>156(43%)</td>
<td>58(16%)</td>
<td>0.005</td>
</tr>
</tbody>
</table>

* Chi-square test

4. DISCUSSION

The questionnaire showed that MSDs were common among the surgical technicians. A vast majority of the study population had experienced some form of MSDs during the past 12 months (85.7%). The comparison of the results of this study with the results of the National Health Survey of Iran (2001) revealed that the differences between the prevalence of MSDs among the STs studied and the general Iranian population were significant (Table 4). This indicates that surgical technician job can be considered as a high-risk occupation for developing MSDs.

Table 4: Comparison of point prevalence of musculoskeletal symptoms in neck, back and large joints in general Iranian population and the STs studied.

<table>
<thead>
<tr>
<th>Body region</th>
<th>STs (age = 19 - 62)</th>
<th>General Iranian population (age = 15 - 69)</th>
<th>P-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck</td>
<td>51.9%</td>
<td>10.2%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Upper and lower back</td>
<td>70%</td>
<td>25.29%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Large joints†</td>
<td>82.0%</td>
<td>20%</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

* Test of proportion
† Including: Shoulders, elbows, wrists, knees and ankles

This indicated that the problem of musculoskeletal disorders in this occupation was serious and needed appropriate attention.

Lower back, legs/feet, knees and upper back symptoms were found to be the most prevalent problem among the surgical technicians studied. This could be attributable to awkward working postures, manual material handling and long time of standing work, which were common in almost all job activities observed. This implies that any interventional program for preventing or reducing musculoskeletal problems among the STs should focus on reducing physical exposure to the MSDs risk factors of these regions.

Statistical analysis showed that among demographic variables considered in this study, only sex was found to be associated with the prevalence of reported symptoms in lower back, shoulders, wrists/hands, upper back and ankles/feet (P<0.05). The symptoms were more prevalent among female than their male counterparts. This is in line with the results of other studies (Chiang, 1993), (Bernard, 1994), (Hales, 1994).

In spite of the fact that diverse types of surgery imposed different level of physical and psychological demands on the STs (i.e., orthopedics and neurosurgery needed high physical demands and long hours of standing work lasting from 1.5 to 8 hours, and cardiac surgery was very stressful with high psychological demands), but statistical analysis showed no association between types of surgery and the prevalence rates of symptoms in body regions of the STs (P>0.05). This finding might be due to involvement of STs in different types of surgeries, particularly in general hospitals.
5. Conclusion

Based on the results, it was concluded that WMSDs occurred in high rate in this occupation. Taking corrective measures for reducing risk level into consideration seemed essential. Any ergonomics intervention program in the workplace should be focused on eliminating awkward postures, manual handling of heavy loads and reduction of time of standing work. Equipping surgery workstations with an appropriate chair may be considered as an ergonomic solution for risk factors elimination.

6. Some guidelines for WMSDs prevention

■ For items that will be manually lifted, shelf height should be from approximately knuckle (with arms at side) to shoulder height. Store heavy and frequently used items in this range. Storage of lightweight and infrequently used items above and below this range is acceptable (figure 5)(OSHA, 2004).

![Figure 5: Manual Material Handling-Shelves](image)

■ If you must stand for long periods, rest 1 foot on a low stool to relieve pressure on your lower back and decrease lordosis. Every 5 to 15 minutes, switch the foot you're resting on the stool. Maintain good posture: Keep your ears, shoulders and hips in a straight line, with your head up and your stomach pulled (figure 6)(Familydoctor.org, 2006)

![Figure 6: Good posture for long standing (B)](image)
Don’t lift by bending over. Lift an object by bending your knees and squatting to pick up the object. Keep your back straight and hold the object close to your body. Avoid twisting your body while lifting. (figure 7)

Push rather than pull when you must move heavy objects (Familydoctor.org, 2006)

As with any activity, it is critical to take frequent rests in order to prevent cumulative strain of tendons and soft tissues structure. Experts suggest that removing one self completely from the activity and taking a 10-minute break every hour will increase productivity and ease tension buildup. Stretch for the upper back and trunk include stretching while sitting or standing. This stretch is performed as follows: while sitting straight, extend the right hand straight above the head and place the left hand at the hip. Stretch the extended hand to the left without leaning forward or back and briefly hold the stretch repeat to the other side. Alternate this stretch several times for maximum benefit (figure 8-A) (Sanders, 2004).

To stretch of the muscles of the back and side, this exercise is beneficial. Slide to the front of the chair and place the right hand on the outside of the left knee. Reach the left hand behind as far as possible without straining, and hold the back of the seat of the chair while using the right hand to control the stretch. The head should follow the left hand and extend the gaze past the left shoulder Do not let the shoulders drop or lean the left hand behind the body. Hold this position for a count of 10, and repeat to the other side; continue to alternate from side to side (figure 8-B) (Sanders, 2004).
Gentle head rolls alternated with shoulder rolls will keep the muscle of the shoulder and neck from becoming stiff. Rotate the shoulders and arms in a circular motion, moving forward several times and then moving backward several times. Make circle in large and small motions. A brisk walk will increase both energy and productivity.

Stretching activities are designed to interrupt the static positions and promote blood flow in body areas used. Stretches can perform at lunch or after each surgery. Stretches are demonstrated and reviewed in figure (Figure 9).

A. Extending the arms overhead, stretches the shoulder and elbow musculature while reinforcing posture (Figure 9-A).
B. Gentle neck circle stretch trapezius, scalene and Sternocleidomastoid muscle (Figure 9-B).
C. Clasping the hands behind the neck, gently stretch pectoral muscle (Figure 9-C) (Sanders, 2004).

Additional stretches recommended are wrist flexion with the elbow extended, wrist rotation and thumb extension after each surgery and hold the stretches for at least 7 seconds. Extending the fingers during instrument retrieval helps relieve tight thumb and finger flexor musculature (Figure 9-D)(Sanders, 2004).
7. References


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