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Research Article

OCCUPATIONAL HAZARDS FACING DOCTORS ESPECIALLY IN THE FIELD OF ORTHOPEDIC SURGERY

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Abstract:

Introduction: Minimal invasive surgeries have been performed on the patients for the well-known advantages of it and it has been used in several fields of surgery such as general surgery, gynecology & obstetrics, urology and cardio thoracic etc. Concentration of surgeon and his quality of skill required is very high especially when it comes to fine work required in MIS.

Objectives: To assess the awareness of ergonomic guidelines in surgeons of SZH, to study the level of self-reported adherence to ergonomics guidelines in minimally invasive surgeries by surgeons and residents working in surgical and allied disciplines at Shaikh Zayed Hospital.

Methodology: Study Design: It is a cross-sectional study.

Procedure: The study was conducted with the help of a questionnaire. The copies of the questionnaire were handed out from August 20, 2014 to August 22, 2014 to 48 available doctors of the above mentioned departments at the time of distribution of the questionnaires and were collected by August 23, 2014. A total of 43 doctors responded by returning answered questionnaires. With a total of 94 doctors working in these departments according to the list provided by the administration, the response rate was 46%. Duration of practice as a surgeon was considered along with total working hours per day, per week and the number of MIS performed per week and per month. Operating room factors considered were height of monitor, size of monitor and height of the table used. Factors of physical discomfort considered were neck pain, shoulder pain, arm pain, knee pain and pain in feet and it was also asked if it needed medication or not. They were also asked if they were comfortable with their eye-hand-target axis and if they were aware about ergonomic guidelines.

Data Analysis: Data collected, was entered into SPSS version 21.

Conclusion: A higher than expected number of surgeons is unaware of ergonomic guidelines (51%). Even then, many are comfortable with table height and monitor height. A high percentage (46.5%) of surgeons suffers from neck pain during or after surgeries. Shoulder pain, knee pain, arm pain and feet pain are less common. Low table height is associated with physical discomfort expressed as knee pain, shoulder pain and arm pain. Greater than 26 inch monitors are more comfortable than 14 inch monitors.

Keywords: Occupational Hazards, Doctors, Field of Orthopedic Surgery.

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INTRODUCTION:

Minimal invasive surgeries have been performed on the patients for the well-known advantages of it and it has been used in several fields of surgery such as general surgery, gynecology & obstetrics, urology and cardio thoracic etc. Concentration of surgeon and his quality of skill required is very high especially when it comes to fine work required in MIS. Hence there is an increasing need to follow basic ergonomic guidelines to make it relatively easy for the surgeons and improve their efficiency and safety of the procedures. Ergonomics is defined by International Ergonomics Association as: "Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance."

Surgeons working in operating rooms which have not been designed according to their comfort and needs make them prone to musculoskeletal pain and injuries (1). Designing a surgical unit by keeping in view the needs and comfort of surgeons is not only likely to make their job easy but also help their confidence and reduce their stress (6). Factors that are most likely to affect his/her approach are the height of the table and the size and height of monitor. The staff should be able to adjust these according to the need but due the lack of understanding and ignorance of ergonomic guidelines, surgeons may perform MIS in a way which is either not safe or a cause of discomfort [7, 8]. This research will study the correlation between table height, monitor height and size and the development of pain in neck, arms, shoulder, knee or feet and also the awareness regarding ergonomic guidelines among the surgeons of Shaikh Zayed Hospital.

Literature Review

A research conducted by Matern & Koneczny (2007) studied ergonomics in the operating room with the objective to address the lack of information regarding the working conditions in the operating room and it showed the results that there were elementary ergonomic deficiencies within all fields and many surgeons said that these deficiencies lead to potential hazards for patients and staff, potentially on a frequent basis. 97% of the surveyed surgeons see ergonomic improvement in operating room as necessary (3).

A study which focused primarily on the posture and axial skeletal and upper extremity movements during laparoscopic surgery conducted by Nguyen et al.

(2001) concluded that laparoscopic surgery involved a posture of the neck and trunk that should be more static, but more frequent movements of the upper extremities than other surgeries. Ergonomic changes in the operation theatre environment and instrument design could ease the stress imposed on surgeons during laparoscopic operations (4).

Szeto et al. (2009) conducted a survey on work-related musculoskeletal symptoms among the surgeons of Hong Kong. The results indicated a high prevalence rate of work-related musculoskeletal symptoms in surgeons in the neck (83%), lower back (68%), shoulder (58%) and upper back (53%) areas. Staying in the same posture and certain small movements was perceived as the factor commonly associated with neck symptoms by 89% of the respondents. The study concluded that there was a strong association between the physical and psychosocial factors with the musculoskeletal symptoms in surgeons (1).

Objectives

1. To assess the awareness of ergonomic guidelines in surgeons of SZH.
2. To study the level of self-reported adherence to ergonomics guidelines in minimally invasive surgeries by surgeons and residents working in surgical and allied disciplines at Shaikh Zayed Hospital.

Aim

The study is conducted to find out if there is a significant relationship between the table height, monitor height & size and musculoskeletal pain occurring in the surgeons during or after surgery and to check their comfort level within their work environment.

Hypotheses

1. There will be significant association between the height of monitor and neck pain.
2. There will be a significant association between the size of monitor and neck pain.
3. There will be significant association between height of the table being used and knee pain.
4. There will be significant association between the height of the table being used and shoulder pain.
5. There will be a significant association between the height of the table being used and arm pain.
6. There will be significant association between working hours per day and feet pain.
7. There will be a negative correlation between comfortable eye-hand-target axis and arm pain.

METHODOLOGY:**Inclusive Criteria**

The study was conducted within Shaikh Zayed Hospital in Lahore and surgeons who were included in it were faculty members (professors, associate professors, assistant professors), post-graduate trainees (trainee registrars, senior house officers, senior registrars, senior medical officers) and belonged to the departments of general surgery, gynae & obs., ophthalmology and ENT. The nurses and members of the paramedical staff were not included in the study.

Study Design

It is a cross-sectional study.

Procedure

The study was conducted with the help of a questionnaire. The copies of the questionnaire were handed out from August 20, 2014 to August 22, 2014 to 48 available doctors of the above mentioned departments at the time of distribution of the questionnaires and were collected by August 23, 2014. A total of 43 doctors responded by returning answered questionnaires. With a total of 94 doctors

working in these departments according to the list provided by the administration, the response rate was 46%.

Duration of practice as a surgeon was considered along with total working hours per day, per week and the number of MIS performed per week and per month. Operating room factors considered were height of monitor, size of monitor and height of the table used. Factors of physical discomfort considered were neck pain, shoulder pain, arm pain, knee pain and pain in feet and it was also asked if it needed medication or not. They were also asked if they were comfortable with their eye-hand-target axis and if they were aware about ergonomic guidelines.

Data Analysis

Data collected, was entered into SPSS version 21. Then frequencies and correlations between different variables were observed and were noted down. Hypotheses formulated about the expected association between operating room factors (table height, monitor height and size) and physical discomfort (neck, shoulder, knee, arm, feet pain) were tested with Chi-Square tests and results were noted and conclusions were made.

RESULTS:**Respondents Characteristics**

Of the doctors who responded only three were faculty members (7%) while the rest did not belong to faculty.

Table 1: Designations of Respondents

| Designation of Respondents | Number of Respondents Percent | Percent |
|----------------------------|----------------------------------|---------|
| Assistant Professor | 1 | 2.3 |
| Associate Professor | 2 | 4.7 |
| Senior House Officer | 3 | 7.0 |
| Senior Medical Officer | 1 | 2.3 |
| Senior Registrar | 1 | 2.3 |
| Trainee Registrar | 33 | 76.7 |
| Trainee Registrar (MS) | 2 | 4.7 |
| Total | 43 | 100.0 |

42% of the respondents belonged to general surgery department.

Table 2: Respondents' Distribution According to the Department they belong

| Department | Number of Respondents | Percent |
|--------------------------|-----------------------|---------|
| ENT | 6 | 14.0 |
| G. S. | 18 | 41.9 |
| Gynaecology & Obstetrics | 12 | 27.9 |
| Ophthalmology | 7 | 16.3 |
| Total | 43 | 100.0 |

Self-reported Awareness

21 out of 43 doctors surveyed, which is about 51%, reported unawareness with ergonomic guidelines. While 20 reported that they have knowledge of ergonomic guidelines (46.5%). 2 didn't respond to the question.

Height of Monitor

33 of the total 43 surgeons (76.7%) said that the monitor they used was at their eye level. 9 out of 43

said it was above eye level (20.9%) and 1 said it was below eye level (2.3%).

Of those (33) who said that the monitors they use are at their eye level, 27 reported that they were comfortable with it (81%) and rest of the 6 mentioned that it should be either above or below their eye level. 31 out of 43 were comfortable with whatever the height of monitor they were using which is a 72% satisfaction rate.

Table 3: Height of the Monitor in Use * Comfortable Height of Monitor

| | | Comfortable Height of Monitor | | | Total | Pearson Chi-Square Value |
|------------------------------|-----------------|-------------------------------|-----------------|-----------------|-------|--------------------------|
| | | At Eye Level | Above Eye Level | Below Eye Level | | |
| Height of the Monitor in Use | At Eye Level | 27 | 4 | 2 | 33 | 0.003 |
| | Above Eye Level | 6 | 3 | 0 | 9 | |
| | Below Eye Level | 0 | 0 | 1 | 1 | |
| Total | 33 | 7 | 3 | 43 | | |

Size of the Monitor

20 out of 43 reported their monitor size to be 14 inches (46.5%), 21 (48.8%) to be 26 inches and 2 (4.7%) to be greater than 26 inches.

22 out of 43 (51%) were not satisfied with the size of monitor they were using and reported that they might

be comfortable using a bigger screen. 20 (46.5%) said that >26 inch screen would be satisfactory for their use. Least number of surgeons showing satisfaction with the size of their monitors were those using one of 14 inch while there was a significant satisfaction with surgeons using 26 inch and greater than 26 inch screens.

Table 4: Size of Monitor * Comfortable Size of Monitor

| | | Comfortable Size of Monitor | | | Total | Pearson Chi-Square Value |
|---------------------|------|-----------------------------|-----|------|-------|--------------------------|
| | | 14" | 26" | >26" | | |
| Size of the Monitor | 14" | 6 | 4 | 10 | 20 | 0.008 |
| | 26" | 0 | 13 | 8 | 21 | |
| | >26" | 0 | 0 | 2 | 2 | |
| Total | 6 | 17 | 20 | 43 | | |

Height of Table

26 out of 43 (60.5%) said that the table on which they perform surgeries has a height which is about their umbilical level. 15 (34.9%) said their table's height is above umbilical level and 2 (4.7%) reported it to be below umbilical level.

Out of 26 who reported that the height of the table they use is about their umbilical level, 24 said that they were comfortable with the height of the table (92%), and out of 15 who said that their table's height was above their umbilical level, 11 were satisfied with it (73%). A total of 35 out of 43 were comfortable with their table's height (81%).

Table 5: Height of Table * Comfortable Height of Table

| | | Comfortable Height of Table | | | Total | Pearson Chi-Square Value |
|-----------------|-----------------------|-----------------------------|--------------------------|--------------------------|-------|--------------------------------|
| | | At Umbilical Level | Above Umbilical Level | Below Umbilical Level | | |
| Height of Table | At Umbilical Level | 24 | 1 | 1 | 26 | 0.000 |
| | Above Umbilical Level | 4 | 11 | 0 | 15 | |
| | Below Umbilical Level | 2 | 0 | 0 | 2 | |
| Total | | 30 | 12 | 1 | 43 | |

Frequency of Neck Pain

20 out of 43 reported neck pain during or after surgery (46.5%) while 23 did not which is about 53.5% of the total.

Frequency of Shoulder Pain

11 out of 43 reported shoulder pain during or after surgery (25.6%) while 32 said they haven't encountered shoulder pain (74.4%).

Frequency of Arm Pain

14 out of 43 said they have felt arm pain during or after surgery one time or another (32.6%) while 29 said they do not (67.4%).

Frequency of Knee Pain

7 out of 43 said they have felt knee pain during or after surgery one time or another (16.3%) while 36 (83.7%) said they haven't.

Frequency of Feet Pain

17 out of 43 said they have felt feet pain during or after surgery one time or another (39.5%) while 26 said they haven't (60.5%).

Hypothesis 1: There will be significant association between the height of monitor and neck pain.

Table 4 below shows cross tabulation between height of monitor in use and occurrence of neck pain during surgery. Chi-Square analysis shows there is no significant association between height of monitor and neck pain.

Table 6: Height of the Monitor in Use * Neck Pain during Surgery

| | | Neck Pain During Surgery | | Total | Pearson Chi-Square Value |
|------------------------------|-----------------|--------------------------|----|-------|-----------------------------|
| | | Yes | No | | |
| Height of the Monitor in Use | At Eye Level | 17 | 16 | 33 | 0.401 |
| | Above Eye Level | 3 | 6 | 9 | |
| | Below Eye Level | 0 | 1 | 1 | |
| Total | | 20 | 23 | 43 | |

Hypothesis 2: There will be a significant association between the size of monitor and neck pain.

Table 5 below shows cross tabulation between size of monitor in use and occurrence of neck pain during surgery. Chi-Square analysis shows there is no significant association between size of monitor and neck pain.

Table 7: Size of Monitor * Neck Pain during Surgery

| | | NeckPainDuring Surgery | | Total | Pearson Chi-Square Value |
|----------------|------|------------------------|----|-------|-----------------------------|
| | | Yes | No | | |
| Sizeof Monitor | 14" | 8 | 12 | 20 | 0.266 |
| | 26" | 10 | 11 | 21 | |
| | >26" | 2 | 0 | 2 | |
| Total | | 20 | 23 | 43 | |

Hypothesis 3: There will be significant association between height of the table being used and knee pain. When this hypothesis was tested with Chi-Square, it showed remarkable results. Those surgeons who reported that the height of the table on which they perform surgeries was about the level of their umbilical region or above umbilical region, showed no significant association with knee pain and majority of them did not complain of knee pain. But the two of the total forty-three who reported that their

table's height did not match their umbilical region and is low also reported that they suffer from knee pain. This can be explained by the fact that surgeons working on low table heights have to keep their standing posture a little awkwardly bent to have a comfortable approach towards the patient. Back pain has not been studied in this research; otherwise, it would have been interesting to note the association here.

Table 8: Height of Table * Knee Pain during Surgery

| | | KneePainDuring Surgery | | Total | Pearson SquareValue | Chi |
|-------------------|----------------------|------------------------|----|-------|------------------------|-----|
| | | Yes | No | | | |
| Height ofTable | AtUmbilicalLevel | 1 | 25 | 26 | 0.001 | |
| | AboveUmbilical Level | 4 | 11 | 15 | | |
| | BelowUmbilical Level | 2 | 0 | 2 | | |
| Total | | 7 | 36 | 43 | | |

Hypothesis 4: There will be significant association between the height of the table being used and shoulder pain.

When this hypothesis was tested with Chi-Square, it showed remarkable results. Those surgeons who reported that the height of the table on which they perform surgeries was about the level of their umbilical region or above umbilical region, showed no significant association with shoulder pain and

majority of them did not complain of shoulder pain. But the two of the total forty-three who reported that their table's height did not match their umbilical region and is low also reported that they suffer from shoulder pain. This can be explained by the fact that surgeons working on low table heights have to keep their standing posture a little awkwardly bent to have a comfortable approach towards the patient.

Table 9: Height of Table * Shoulder Pain during Surgery

| | | ShoulderPainDuring Surgery | | Total | Pearson Chi-Square Value |
|----------------|----------------------|----------------------------|----|-------|--------------------------|
| | | Yes | No | | |
| Heightof Table | AtUmbilicalLevel | 7 | 19 | 26 | 0.030 |
| | AboveUmbilical Level | 2 | 13 | 15 | |
| | BelowUmbilical Level | 2 | 0 | 2 | |
| Total | | 11 | 32 | 43 | |

Hypothesis 5: There will be a significant association between the height of the table being used and arm pain.

When this hypothesis was tested with Chi-Square, it showed remarkable results. Those surgeons who reported that the height of the table on which they perform surgeries was about the level of their umbilical region or above umbilical region, showed no significant association with arm pain and majority

of them did not complain of arm pain. But the two of the total forty-three who reported that their table's height did not match their umbilical region and is low also reported that they suffer from arm pain. This can be explained by the fact that surgeons working on low table heights have to keep an awkward upper extremity posture to have a comfortable approach towards the patient.

Table 10: Height of Table * Arm Pain during Surgery

| | | ArmPainDuring Surgery | | Total | Pearson Chi-SquareValue |
|----------------|----------------------|-----------------------|----|-------|-------------------------|
| | | Yes | No | | |
| Heightof Table | AtUmbilicalLevel | 6 | 20 | 26 | 0.061 |
| | AboveUmbilical Level | 6 | 9 | 15 | |
| | BelowUmbilical Level | 2 | 0 | 2 | |
| Total | | 14 | 29 | 43 | |

Hypothesis 6: There will be significant association between working hours per day and feet pain.

Table 9 shows cross-tabulation between working hours per day of a surgeon and feet pain. Chi-Square test shows that there is no significant association between working hours in a day and feet pain.

Table 11: Working Hours per Day * Feet Pain during Surgery

| | | FeetPainDuring Surgery | | Total | Pearson Chi-Square Value |
|---------------------|-------|------------------------|----|-------|--------------------------|
| | | Yes | No | | |
| WorkingHours perDay | 6.00 | 6 | 9 | 15 | 0.791 |
| | 7.00 | 3 | 3 | 6 | |
| | 8.00 | 6 | 8 | 14 | |
| | 9.00 | 0 | 1 | 1 | |
| | 10.00 | 2 | 2 | 4 | |
| | 14.00 | 0 | 2 | 2 | |
| | 15.00 | 0 | 1 | 1 | |
| Total | | 17 | 26 | 43 | |

Hypothesis 7: There will be a negative correlation between comfortable eye-hand-target axis and arm pain.

Table 10 shows cross tabulation between comfortable eye-hand-target axis and arm pain. Chi-Square test

shows that there is no significant association between comfortable eye-hand-target axis and arm pain although there is an increase in percentage of the surgeons reporting arm pain who also report uncomfortable eye-hand-target axis.

Table 12: Comfortable Eye-Hand-Target Axis * Arm Pain during Surgery

| | | ArmPainDuring Surgery | | Total | PearsonChi-Square Value |
|----------------------------------|-----|-----------------------|----|-------|-------------------------|
| | | Yes | No | | |
| ComfortableEye HandTargetAxis | Yes | 11 | 25 | 36 | 0.525 |
| | No | 3 | 4 | 7 | |
| Total | | 14 | 29 | 43 | |

DISCUSSION:

A majority percentage (51%) of surgeons in SZH is unaware of ergonomic guidelines which is higher than expected and it also makes it even harder to work for and implementing a system resulting in quality ergonomic conditions for surgeons. The study conducted by Modi, Kuswaha, Dave (2007) in three medical colleges and teaching hospitals of Ahmedabad concluded with 64% of the surgeons reporting that they were aware of ergonomic guidelines regarding laparoscopic surgery while the practice of it were somewhat lower at about 54% and 4% respectively in terms of table height and monitor height. They hadn't studied the causes of this lower practice and commented that it may be due the nonadjustable table and monitor height. In SZH, despite the fact that a large number of surgeons are unaware of ergonomic guidelines, they have defined their comfort zone especially when it comes to table height and monitor height but not in the case of the size of monitor (2). The causes have not been studied in this research either but it can be explained by the adjustable height of the tables and monitors used here. Size of monitors installed by the hospital administration being nonadjustable, creates discomfort for many surgeons.

The study conducted by Szeto, et al. (2009) among the surgeons in Hong Kong reported that 82.9% surgeons feel pain in the neck during or after surgeries. Through this we may infer that a surgeon's neck is vulnerable to musculoskeletal pain due to a sustained posture during surgery (1). In our study which was conducted in SZH, physical discomfort was found less prevalent but those who did report a physical discomfort the chief complaint was also found to be of neck pain with 46.5% saying that they feel neck pain during or after surgery but don't

require any medication for its cure. This means that although physical discomfort is an issue, it is not a serious one here.

It was expected that there would be close association between operating room factors and physical discomfort and several assumptions were made regarding this. But the results proved that there was little association between uncomfortable monitor height and neck pain etc. with only bad table height knowing to cause knee, arm, shoulder pain. Bad table height causes a surgeon to remain in a sustained awkward and uncomfortable posture which results in several health issues.

Study conducted by Wauben, Veelen, Gossot & Goossens (2006) had similar results to this study. On the whole, almost 80% respondents reported neck, shoulder and back discomforts and there was no specific cause for these physical discomforts. But the information which turned out to be the hallmark of that research was that a clear majority (89%) of respondents, similar to this study, were unaware of the ergonomic guidelines. Study concluded with the statement that lack of ergonomic guidelines was a major problem in the operating room (5).

CONCLUSION:

A higher than expected number of surgeons is unaware of ergonomic guidelines (51%). Even then, many are comfortable with table height and monitor height. A high percentage (46.5%) of surgeons suffers from neck pain during or after surgeries. Shoulder pain, knee pain, arm pain and feet pain are less common. Low table height is associated with physical discomfort expressed as knee pain, shoulder pain and arm pain. Greater than 26 inch monitors are more comfortable than 14 inch monitors.

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