

Surgeons’ awareness about ergonomics in the operation theatre

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ABSTRACT

Background: Musculoskeletal symptoms are common among surgeons who work in an environment that is not ergonomically ideal.

Objective: To determine the surgeons’ awareness of ergonomics in the operation theatre and factors that may lead to musculoskeletal symptoms.

Methods: A cross-sectional study was conducted from January to March 2024 in the Department of General Surgery, Pakistan Institute of Medical Sciences, Islamabad, Pakistan. The survey was conducted among 110 surgeons working in different surgical specialties. A 30-item questionnaire was designed to ascertain knowledge, attitude, and practices about posture ergonomics among surgeons and was distributed online using Google Forms. The severity of pain was calculated using the Visual Analogue Score (VAS). Factors that contribute to musculoskeletal symptoms were also investigated. Data was collected and analyzed using SPSS version 26

Results: A total of 74 doctors responded to the questionnaire. Out of these, 71.6% were males and 28.4% were females, with a mean age of 38.87±11.4 years. The majority (91.9%) had some discomfort or pain during/after performing the surgery. Backache was the most common (22.8%), followed by pain in the legs (21.4%), neck (17.8%), shoulders (16.6%), hands (14.6%), and wrists (6.8%). Prolonged standing in the same position (52.7%), bad posture (33.8%), and performing a large number of surgeries daily (33.8%) were the major factors for their symptoms. Most surgeons (85.1%) knew about ergonomics in general. Only 32.4% of responders had received ergonomics education, while 67.6% did not.

Conclusion: There is a deficiency of awareness of ergonomics among surgeons. Lack of ergonomics training and inadequate operation theatre resources are the leading causes of surgeons' pain with postural ergonomics.

Key Words: Awareness, Ergonomics, Operation theatre, Surgeons, Musculoskeletal symptoms

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INTRODUCTION

Surgeons frequently have musculoskeletal symptoms, especially during lengthy procedures that necessitate operating in a static posture for an extended time.¹ A third or fewer of the surgeons polled in earlier studies

on ergonomics knowledge reported having any prior training or awareness of appropriate operating room (OR) ergonomics.^{2,3} The medical community, and surgery in particular, is not well aware of ergonomics, which is a significant contributing cause to poor musculoskeletal outcomes. Surprisingly, 55-99% of surgeons across several sub-specialties report having no prior awareness of ergonomics concepts, despite a significant portion of surgeons reporting that musculoskeletal pain is directly related to poor surgeon body posture during surgery.^{4,5}

Surgeons often experience musculoskeletal issues, particularly during lengthy operations that need them to work in a stationary position for an extended amount of time. The effects of operating room ergonomics on surgeons' health are frequently unknown to them. Since overexertion is a major contributor to musculoskeletal injuries, understanding ergonomics in the operating room is crucial for both a safe and effective procedure.⁶ The operative tasks that

surgeons execute daily need minutes to hours of maintained posture and constant static exertion in addition to mental clarity, concentration, hand-eye coordination, and exact movement execution. Even though a surgical operating room is a dynamic, ever-changing environment, most surgeons adopt an unfavorable body posture that compromises their ability to expose and access the surgical area of interest in the best possible way. Ergonomics is defined as "Designing the working environment to fit the worker, instead of forcing the worker to fit the working environment". Recent research has highlighted the risks associated with poor workplace ergonomics.⁶

Surgeons' awareness of ergonomics in the operation theatre is a critical yet often overlooked aspect of their work environment. According to research, musculoskeletal illnesses related to the job are very common among medical professionals who work in operating rooms, with a significant percentage experiencing pain due to occupational responsibilities, particularly affecting the lumbar spine, neck, and shoulders.⁷ Despite the widespread impact of poor ergonomics, only a tiny percentage of workers have received training on ergonomics, highlighting a deficiency in ergonomic practices that demands effective intervention. Surgeons, by instinct, utilize ergonomics in their daily practice by positioning patients and instruments for optimal performance.⁸ Formal education on ergonomics emphasizes its importance in enhancing surgical outcomes and reducing the risk of musculoskeletal injuries.⁹ Efforts to improve ergonomics in the operation theatre, including implementing intra-operative micro-breaks and providing ergonomic training, are crucial to promoting surgeon health and well-being.¹⁰

Creating an environment that works for employees rather than making them fit into the workplace is the fundamental idea behind ergonomics. If there is inadequate ergonomics training, discussion, and application, the surgeons are more likely to suffer from musculoskeletal pain. This impacts the speed of the surgical procedure, the surgeon's focus, accuracy at work, sleep, and personal life quality.¹¹

The objective of the current study was to determine the surgeons' awareness of ergonomics in the operation theatre and factors that may lead to musculoskeletal symptoms.

METHODS

A survey-based cross-sectional study was conducted from January to March 2024 at the Department of General Surgery, Pakistan Institute of Medical Sciences Islamabad, Pakistan. The sample size of 110 was calculated using the Survey Monkey sample size calculator, keeping a 95% Confidence level, a 5% margin of error, and 150 population size of surgeons in the hospital. The study included surgeons of 25-65 years of age, both genders, residents, and surgeons with the last 6 months of experience in surgery or allied specialties. The study did not include participants with congenital musculoskeletal disorders, migraine, chronic back pain, hypertension, or diabetes.

A 30-item questionnaire was designed to gather information regarding knowledge, attitude, and practices about posture ergonomics among surgeons by consecutive sampling after taking informed consent. The designed questionnaire was distributed through an online Google form. The questionnaire was composed primarily of objective questions to make it easier to use and save time. The survey's first portion covered demographic information such as years of experience, designation, body height, weight, age, and sex. The surgeons' attitudes and practices regarding ergonomics were the subject of the second segment. Closed-ended questions regarding reasons for not adhering to postural ergonomics were added. Musculoskeletal symptoms like pain, its site, and duration were also asked. The severity of pain was calculated using the Visual Analogue Score (VAS). Factors that contribute to musculoskeletal symptoms were also investigated. Common measures used by the surgeons to prevent or decrease musculoskeletal symptoms were asked. Elements of the operating room environment that can be improved were also asked. Multiple answers were permitted for certain questions. The third section was related to knowledge about ergonomics and whether any training was provided via workshops or lectures. The responses from surgeons were collected and the response rate was 67%.

Ethical Approval

Ethical approval was taken from the Ethics Research Review Board, Pakistan Institute of Medical Sciences, Islamabad, Pakistan (F.3-1/2024-ERRB), dated 13th January 2024).

Statistical Analysis

Data was collected and analyzed using SPSS version 26. Qualitative variables were presented as frequencies and percentages.

RESULTS

A total of 74 surgeons responded to the questionnaire. Among these participants, 71.6% were males and 28.4% were females. The mean age of the participants was 38.87±11.4 years. The median height of the participants was 5 ft 7 inches (5'2"-6'1"). The demographic data of the surgeons who participated in the study is shown in Table 1.

Table 1: Demographics of the study participants

Characteristics	Frequency (n)	Percentage (%)
Age (years)		
<30	18	24.4
31-40	24	32.5
41-50	21	28.4
>50	11	14.7
Gender		
Male	53	71.6
Female	21	28.4
Specialty		
General Surgery	41	55.5
Orthopaedics	15	20.3
Neurosurgery	07	9.5
Others	11	14.7
Height (feet, inches)		
≤5'	0	0
5'1"-5'4"	15	20.3
5'5"-5'8"	35	47.3
5'9"-6'	21	28.4
>6'	03	4.0
Designation		
Junior PGR	16	21.6
Senior PGR	16	21.6
SR/AP/SS	19	25.7
Assoc Prof/Prof/CS	23	31.1
Years of Experience (years)		
<5	32	43.3
5-10	15	20.2
11-15	05	6.7
>15	22	29.8

PGR: Postgraduate Resident, SR: Senior Registrar, AP: Assistant Professor, SS: Surgical Specialist, Assoc Prof: Associate Professor, Prof: Professor, CS: Consultant Surgeon

It was observed that 68 (91.9%) had some musculoskeletal pain while and/or after performing surgery, and only 6 (8.1%) participants didn't experience any symptoms. The majority of participants (22.8%) experienced pain in the back, followed by legs (21.4%), neck (17.8%), shoulders (16.6%), hands (14.6%), and wrists (6.8%). The severity of the musculoskeletal pain calculated by Visual Analogue Score (VAS) is shown in Figure 1, where 14 participants experienced mild pain (VAS=3), and 25 participants experienced moderate pain (VAS=5 & 6).

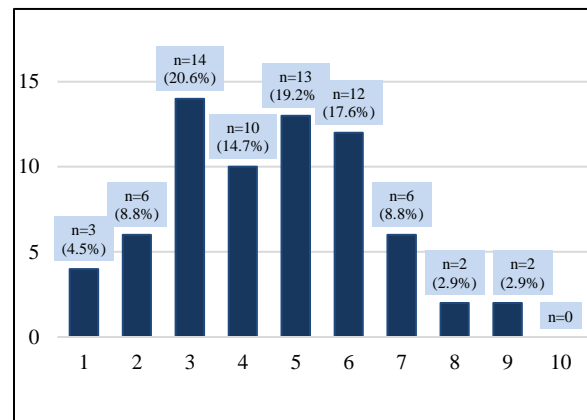


Figure 1: Visual Analogue Score for pain severity of the study participants

Other symptoms experienced by participants are shown in Table 2, all the time being the most severe and never being the least. In 51%, sleep was never affected, whereas 27% reported occasional sleep disturbance. Muscle Stiffness and muscle fatigue were reported occasionally in participants. Most (43%) reported that their recreational activities are rarely affected. Tingling, numbness and eye discomfort and strain were also reported rarely by the study participants (Table 2).

Table 2: Different symptoms experienced by the study participants

Symptoms	Never n (%)	Rarely n (%)	Occasionally n (%)	Mostly n (%)	All the time n (%)
Eye strain/discomfort	23 (31.1)	33 (44.6)	14 (18.9)	03 (4.1)	01 (1.4)
Numbness/tingling in hands	25 (33.8)	27 (36.5)	17 (23)	04 (5.4)	01 (1.4)
Muscle Stiffness	21 (28.4)	19 (25.7)	29 (39.2)	05 (6.8)	00 (0)
Muscle fatigue	08 (10.8)	22 (29.7)	30 (40.5)	14 (18.9)	00 (0)
Sleep affected	38 (51.4)	13 (17.5)	20 (27)	03 (4.1)	00 (0)
Recreational activities affected	12 (16.2)	32 (43.2)	27 (36.5)	03 (4.1)	00 (0)

Prolonged standing in the same position was the major factor found in 39 (52.7%) participants, whereas bad posture in 25 (33.8%) and performing a large number of surgeries daily in 25 (33.8%) were the second most common factors. Other factors were not taking breaks during long cases (28.4%), poor instrument size (27%), and inappropriate table height (24.3%) (Figure 2).

The common techniques used by surgeons to prevent or decrease musculoskeletal symptoms were exercise by 38 (51.4%) and taking breaks during the surgery by 33 (44.6%). Some 17 (23%) use special shoes for standing during the surgery, while 19 (25.7%) don't use any personal equipment or technique to lessen the symptoms.

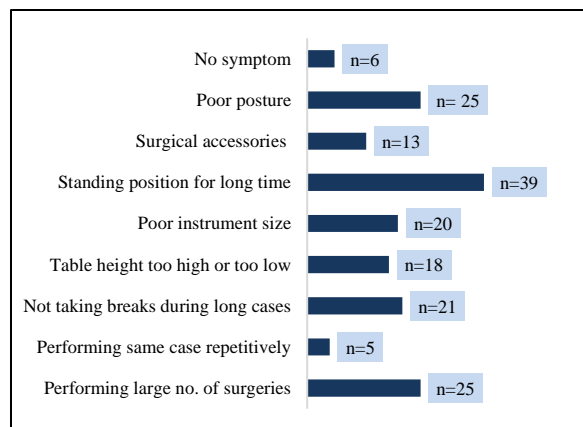


Figure 2: Factors that contribute to musculoskeletal symptoms

When questions about what factors could be improved to decrease musculoskeletal symptoms were asked, 39 (52.7%) said the height of the operation room (OR) tables and 36 (48.6%) said surgical equipment used for open surgery (Figure 3).

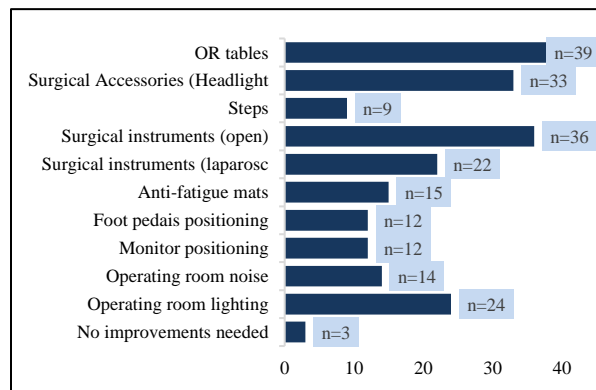


Figure 3: Factor that can be improved to reduce musculoskeletal symptoms in operation Theater

Regarding knowledge about ergonomics response, 63 (85.1%) knew about ergonomics in general, while 10 (13.5%) had no idea about it, and one participant did not answer this question. Regarding ergonomics education, 24 (32.4%) participants reported receiving it, while 50 (67.6%) did not.

DISCUSSION

The present study was conducted to determine the surgeons' awareness of ergonomics in the operation theatre and factors that may lead to musculoskeletal symptoms. Surgeons operate in a setting that is not always ergonomically suitable. The current study reported that the majority of surgeons knew about ergonomics while few had no idea, but proper ergonomic education was received in only 32% of the surgeons. Most of the surgeons had musculoskeletal symptoms due to the poor ergonomic environment of the operation rooms. Prolonged standing in the same position, poor posture, and performing a large number of surgeries are considered to be the major factors contributing to musculoskeletal pain.

Musculoskeletal symptoms associated with surgery are common among surgeons and can result in a decreased quality of life, disability, and shorter career longevity.¹² Surgeons often experience musculoskeletal issues, particularly during lengthy operations that need them to work in a stationary position for an extended amount of time. The findings of this study, similar to the recent research, have highlighted the risks associated with poor workplace ergonomics among surgeons.¹³

In the current study, the mean age of the participants was 38.87 ± 11.4 years and 71.6% were males and 28.4% were females. This finding is similar to other studies. Shrestha et al. found a mean age of 36 years, and 67.3% were males.⁷ Aaron KA et al. also showed that 59.9% of the participants were male.¹ However, in a local study, 66.1% of participants were females.¹⁴ This difference was probably because more participants were from the Gynaecology Department.

As per study findings, 68 (91.9%) participants had some musculoskeletal discomfort or pain, and only six (8.1%) participants did not experience any discomfort or pain while/after performing surgery. This finding confirmed the literature that showed the prevalence of musculoskeletal problems ranging from 20% to 90% in surgeons and health care providers.¹⁵

It was discovered that the back, legs, and neck were the anatomical regions most frequently affected, followed by the shoulders, hands, and wrists. These results are consistent with other research. According to McQuivey et al., the highest frequencies of serious complaints were found in the neck (30%) and lower back (35%).¹⁶ However, a greater frequency in the neck was found by Kokosis et al. and Epstein et al., at 54% and 65%, respectively.^{17,18}

The findings showed that standing for extended periods of time in the OT was the main factor of weariness. The height of the operating table was also evaluated in relation to the standing position that a surgeon would have in his workplace. There were 39 (52.7%) surgeons who reported backache and other musculoskeletal symptoms when the OT tables' height was not appropriate, so table height is important for the surgeons during the procedure. Research showed that inadequate ergonomics training and a lack of appropriate tools were the leading causes of noncompliance with postural ergonomics.¹⁹

Many elements can improve the operation room environment to reduce the surgeon's discomfort. The height of the operation table and the use of proper surgical instruments are the major factors that can be improved as per this survey. Similarly, another survey showed that 40.0% of surgeons with a history of musculoskeletal issues made intraoperative changes.²⁰ Engineering controls are adjustments that can be applied to the actual theatre setting; these include equipment modifications and structural adjustments like table height.⁹

Most of the study participants (87.5%) had knowledge of OT ergonomics in general. Riley et al. highlighted that ergonomics knowledge can prevent musculoskeletal injury and improve task performance.²¹

CONCLUSION

Most of the surgeons had musculoskeletal symptoms due to the poor ergonomic environment of the operation rooms. There is also a deficiency of awareness of ergonomics among surgeons. In order to lower the likelihood of musculoskeletal problems, ergonomics instruction have to be included in the curriculum. Prolonged standing in the same position, poor posture, and performing a large number of surgeries are considered to be the major factors contributing to musculoskeletal pain.

Limitations of the study

The major limitation of the study was the small sample size, which showed the need for a larger cohort to collect more data on the subject.

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AUTHORS' CONTRIBUTION:

MN: Conception of the study, data collection, manuscript drafting, approval of final version to be published

SHW: Data collection, analysis & interpretation, manuscript drafting, approval of final version to be published

ZJ: Manuscript drafting, data acquisition, critical review, approval of final version to be published

FS: Data collection, data analysis, critical review, approval of final version to be published

All Authors agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

CONFLICT OF INTEREST:

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DATA SHARING STATEMENT:

The data are available from the corresponding author upon reasonable request.

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