

Musculoskeletal Symptoms in Surgeons: A Review of the Literature

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2. Keywords

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1. Abstract

There is increasing awareness of surgeons' physical stress and fatigue in the operating room environment. Data suggests that orthopedic and neurological surgeons are especially prone to musculoskeletal complaints related to the physical demands of performing spinal surgery. Spine surgery requires surgeons to adopt non-ergonomic positions for variable amounts of time in an attempt to decompress neural elements, stabilize the spinal column, and correct spinal deformity. While patient outcomes are a focus of healthcare in this country, the impact of surgery upon the surgeon has received far less attention. This literature review was undertaken to elucidate the epidemiology of musculoskeletal symptoms among surgeons as well as to review treatment interventions. Comprehensive review of Pub Med and OVID Medline from 1990-2017 was undertaken; seventeen articles were identified. The epidemiology of and interventions directed towards musculoskeletal complaints in surgeons will be described.

3. Introduction

The medical community is becoming increasingly aware of surgeons' physical stress and fatigue in the operating room environment. Spine surgeons are frequently required to assume awkward body postures, perform repetitive movements, and maintain neck flexion. Advancements such as laparoscopic surgery, while promising improved patient outcomes, have been associated with increased rates of musculoskeletal pain in surgeons.

Emphasizing the ergonomics during surgery is crucial to reduce the musculoskeletal stress experienced by the surgeon while in the workplace environment. Spine surgery requires surgeons to adopt non-ergonomic positions for variable amounts of time in attempt to decompress neural elements, stabilize the spinal column, and correct spinal deformity. While patient outcomes are a focus of healthcare in this country, the impact of surgery on the surgeon has received far less attention. A review of the literature was undertaken to elucidate the epidemiology of musculoskeletal complaints among surgeons as well as highlight various interventions that are currently being developed.

4. Methods

4.1. Search strategy

The literature search included a computerized database search of Pub Med, Ovid MEDLINE and a reference search. The search strategy was aimed at identifying all available published studies regarding the epidemiology of work-related musculoskeletal complaints among surgeons. Key words utilized in the search were the following: (1) surgeon, (2) musculoskeletal pain, (3) occupational disease, (4) epidemiology, and (5) ergonomics. Subsequently, the reference results were examined for additional studies. Multiple reviewers (YL, GK, AG) screened the obtained titles and abstracts for eligibility. Studies were eligible if all the inclusion criteria, as listed below, were met.

4.2. Inclusion criteria

The following inclusion criteria was utilized:

- article published between 1990-2017
- article published in English.
- primary population of interest was surgeons

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- musculoskeletal complaints were defined as musculoskeletal discomfort, musculoskeletal symptoms or musculoskeletal disorders.

5. Results

A comprehensive literature search resulted in 17 articles. A summary of the findings of these articles are presented in **Table 1**.

Author	Study type	Surgical specialty	n	Mean age	Summary
Mirbod et al. 1995	Survey	Orthopedic	54	42.5	- Orthopedic surgeons had a higher prevalence of subjective complaints - Symptoms in the shoulders and lower back were the most common, followed by neck pain
Berguer et al. 1997	Observational	Multiple	4	NR	- Surgeon head and back positions were more extended in laparoscopic procedures and more flexed in open procedures - During laparoscopic procedures, surgeons made significantly fewer lateral neck flexions and trunk flexions than during open procedures
Nguyen et al. 2001	Observational	Laparoscopic	5	43	- Trend toward increased shoulder stiffness following laparoscopic procedures
Albayrak et al. 2007	Interventional	General	7	NR	- Semistanding support was designed to provide support in a natural working position while being compact - 6 of 7 surgeons found the external support system to be comfortable
Park et al. 2010	Survey	Laparoscopic	317	44.3	- 86.9% of surgeons reported physical symptoms or discomfort - 62% of above surgeons also reported their symptoms continued after performing operations
Soueid et al. 2010	Survey	Multiple	77	29.5	- 81% of surgeons had pain while operating and ~ 80% had pain on a regular basis - Back and neck were the most common areas of pain (47% and 39%, respectively) - 43% of surgeons had to take breaks from operating due to their symptoms
Szeto et al. 2010	Observational	Multiple	14	35	- During open surgery, neck posture was primarily in flexion - Increased side to side flexion in cervical spine region during open surgery, whereas laparoscopic procedures resulted in longer durations of static posture
Auerbach et al. 2011	Survey	Orthopedic	561	54	- Spine surgeons have a higher prevalence of musculoskeletal disorders than the general public - Surgical rates for lumbar disc disease (7.1%) and cervical disk disease (4.6%) - Total number of cases correlated with neck pain
Park et al. 2012	Observational	Spine	12	NR	- Whole spine angles were closest to natural standing position when operating with loupes - Optimal operating table height was midpoint between umbilicus and sternum
Park et al. 2014	Observational	Spine	18	NR	- Lumbar lordosis, cervical lordosis, occipital angle, and thoracic kyphosis were closest to natural standing position when operating with a microscope
Knudsen et al. 2014	Survey	Orthopedic	32	47	- 59% of residents had neck pain, 55% lower back pain, 35% upper back pain - 4 residents had to take a break from operating due to their symptoms
AlQahtani et al. 2015	Survey	Multiple	86	45	- 66.7% of surgeons reported a work-related musculoskeletal disorder, low back pain being most common - 26.7% of surgeons required time off of work due to their injuries
Bertolaccini et al. 2015	Observational	Thoracic	3	NR	- Uniportal VATS settings were found to significantly prevent neck extension - Triportal access resulted in greater physical discomfort compared to uniportal
Williams et al. 2016	Survey	Hair restoration	38	NR	- 50% of hair restoration surgeons reported musculoskeletal symptoms during or after performing surgery - Lumbar and cervical pain were among the most common symptoms
Hallbeck et al. 2017	Interventional	Multiple	61	47	- Neck, upper back, lower back pain were the most common symptoms - Inclusion of microbreaks significantly decreased shoulder pain - 88% reported no change or improvement in mental focus
Liu et al. 2017	Interventional	General	20	NR	- Exosuit was developed to provide support to the proximal upper extremity - Surgeons using exosuit experienced significantly less fatigue and arm pain
Park et al. 2017	Interventional	Multiple	66	NR	- 67% of participants reported neck and lower back pain while operating - Microbreaks significantly improved post-procedure pain scores - Overall, TSMB were equally effective for open and laparoscopic surgeries

Abbreviations: NR = Not reported

The primary method of investigation was survey in seven of the 17 articles [2,3,7,9,11,15,17] observation of kinematics in six [4,5,10,13,14,16] and interventional in four [1,6,8,12]. Of the four studies that tested various interventions, two studies focused on body support and two studies focused on “microbreaks,” short two-three-minute targeted stretching breaks designed to occur during surgery without breaking sterility.

In 11 of these studies, the focus was on general surgeons. Park et al. demonstrated that the annual case volume of laparoscopic procedures strongly correlated with neck pain or discomfort [11]. Szeto et al. [16] observational study of open and laparoscopic surgeons in the operating room found that neck flexion was predominant in the former while neck extension was predominant in laparoscopic surgery [16]. Overall, the prevalence of musculoskeletal pain among surgeons has been reported as high as 87% [11].

A total of six studies focused on orthopedic/spine surgeons as the primary population of interest. In regards to spine surgeons, both Auerbach et al. [3] and Knudsen et al. [7] reported neck pain as the most common musculoskeletal disorder for spine surgeons [3,7]. A survey study by Al Qahtani et al. [2] reported that 67% of orthopedic surgeons experienced low back pain; 30% of surgeons surveyed required time off of work.² Park et al. studied the ergonomics of surgeons while operating; loupe magnification and adjustment of operating table height to midpoint between the umbilicus and sternum allowed surgeons to be positioned with lumbar lordosis, cervical lordosis and thoracic kyphosis that were closest to a natural standing position.¹⁴ In multiple studies, annual caseload correlated with neck pain but was not associated with missed days of work [3,11].

Four studies implemented interventions to mitigate these symptoms. Hallbeck et al. [6] and Park et al. found that the introduction of microbreaks during surgery improved post-procedure pain scores in the neck, shoulders, and lower back [6,12]. In both studies, nearly 90% of participants reported a desire to incorporate micro breaks into the operating room routine in the future.

Two investigators introduced the use of body support systems in the operating room [1,8]. Liu et al. [8] designed an exosuit to provide support to the proximal upper extremity; this resulted in significantly less surgeon fatigue and arm pain. In both studies, participants found the body support systems to be comfortable and safe without sacrificing dexterity.

6. Discussion

Primum non nocere, or “first, do no harm,” as taught in medical school, does not address the inherent occupational hazards faced by all physicians. Neither medical school nor residency training

programs educate students as to these risks and their minimization.

Occupational hazards, including radiation exposure, case volume, case length, and use of power instruments can result in surgeon’s becoming patients. Musculoskeletal complaints are prevalent in the surgical subspecialists with 57% and 40% endorsing back and neck pain respectively. Over half of those affected never sought help for their complaints [15].

The prevalence of musculoskeletal complaints is even higher in spine surgeons; both North American Spine Society and the Scoliosis Research Society published member surveys indicate a greater prevalence of neck and back pain in spine surgeons, resulting in medical treatment, missed days of work, and early retirement. Surgical treatment rates for these complaints ranged from 4.6-7.1%.³

7. Conclusion

Physician wellness occurs in many arenas, both inside and outside of the hospital. For surgeons, the operating room environment offers ergonomic challenges. Increased awareness among spine surgeons may lead to earlier preventive and treatment measures thus minimizing disability in this population.

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