
Do No Harm, Except to Ourselves? A Survey of Symptoms and Injuries in Oncologic Surgeons and Pilot Study of an Intraoperative Ergonomic Intervention



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- BACKGROUND:** Occupational symptoms and injuries incurred over a surgical career are under-reported, yet they have an impact on daily surgical practice. We assessed the frequency, consequences, and risk factors for occupational injury in oncologic surgeons and evaluated the feasibility of intraoperative foot mat use to mitigate occupational symptoms.
- STUDY DESIGN:** Oncologic surgeons completed a survey of demographic information and occupational symptoms and injuries. Multivariate logistic regression was used to identify factors associated with occupational symptoms and injuries. A randomized cross-over pilot study of intraoperative foot mat use was conducted.
- RESULTS:** One hundred twenty-seven surgeons completed surveys (response rate: 58%). The most commonly reported symptoms were fatigue, discomfort, stiffness, and back pain. An occupational injury was reported by 27.6% of surgeons. Of those injured, 65.7% received treatment, with 17.4% of those treated requiring surgery for their injury. In multivariate analysis, factors significantly associated with occupational injury were male sex (odds ratio [OR] 3.00, 95% CI 1.08 to 8.38), mean case length of 4 hours or more (OR 2.72, 95% CI 1.08 to 6.87), using a step to operate (OR 3.06, 95% CI 1.02 to 9.15), and neck pain (OR 4.81, 95% CI 1.64 to 14.12). In the foot mat pilot study ($n = 20$), mat use was associated with discomfort (OR 7.57, 95% CI 1.19 to 48.00), but no significant differences in leg volume change due to mat use were found.
- CONCLUSIONS:** Most oncologic surgeons experience musculoskeletal symptoms from operating. Of the 28% of surgeons with an occupational injury, most required treatment. Intraoperative foot mat use was associated with increased discomfort. (*J Am Coll Surg* 2017;224:16–25. © 2016 by the American College of Surgeons. Published by Elsevier Inc. All rights reserved.)
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Over the past few decades, awareness of surgeons' risk of injury in the operating room has greatly increased.¹⁻⁷ Initial surveys reported that pain and stiffness due to

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operating occur in 20% of laparoscopic surgeons.⁸ Later work reported that 100% of laparoscopic surgeons ($n = 61$) experienced occupational symptoms⁵ and used static postures with awkward movements of the upper extremities.⁹ The overall design of the minimally invasive suite and the monitor position also contribute to discomfort.¹⁰ Broader work found an equally alarming frequency of occupational symptoms in nonlaparoscopic surgeons. A survey of British surgeons in various specialties ($n = 77$) revealed that 82% of the surgeons experienced pain while operating.¹¹ In an international survey of 1,215 surgeons, 69% had physical discomfort after performing any surgical modality, with 36% attributing most of their symptoms to performing open surgery.¹² In the same study, 30% of surgeons reported giving at least some consideration to their own anticipated

intraoperative discomfort when choosing a surgical modality (ie open, laparoscopic, or robotic).

Also, evidence suggests that particular groups of surgeons may be at higher risk of occupational symptoms. Female surgeons, for example, reported higher rates of neck and shoulder discomfort due to operating than their male colleagues with the same glove size, and were also significantly more likely to have received treatment for hand problems than the men.¹³ As another example, Hemal and colleagues³ reported that junior laparoscopic surgeons, with less than 2 years of experience, had significantly higher rates of finger numbness and eye strain than their more senior colleagues, despite having an equivalent laparoscopic workload.

Beyond surgeons' experiences of temporary pain or discomfort, occupational injury has also recently been acknowledged. Performing prolonged laparoscopic surgery was correlated with an increased risk of a herniated vertebral disk in gynecologists.¹⁴ Cervical disk herniation requiring operative intervention has been reported as common in plastic surgeons,¹⁵ and carpal tunnel syndrome has been reported as frequent in spine surgeons.¹⁶ In 2014, Davis and associates¹ revealed that 40% of 793 surgeons surveyed sustained 1 or more injuries in the workplace; of the surgeons injured, 22% missed work because of the injury, and 35% had to reduce their operative caseload while recovering.¹ Occupational injuries can affect patient care, reduce hospital revenue, and shorten surgical careers, all at a time when impending shortages of surgeons are predicted.¹⁷ Additional research is critical to identify risk factors for these injuries, including susceptible groups, and ergonomic improvements are needed to improve intraoperative positioning from the current standard postures (Fig. 1). In this study, we sought to assess the frequency of occupational symptoms and injuries in oncologic surgeons in a tertiary cancer center and to identify potential risk factors for injury. We hypothesized that the rates of these symptoms and injuries in oncologic surgeons would be as high as or higher than those in other, previously studied surgical groups.

We also tested the use of commercially available foot mats designed to decrease discomfort for the surgical team. The use of these antifatigue mats is recommended by the Occupational Safety and Health Administration in the operating room to help prevent trauma and pain in the lower extremities.¹⁸ However, despite the wide availability of foot mats, they are inconsistently used in operating rooms. Two previous studies have prospectively evaluated antifatigue mats during endoscopic or laparoscopic procedures, and both reported statistically significant improvement due to the mats in postoperative discomfort and energy levels experienced by surgical teams.^{19,20}



Figure 1. Actual photo of surgeons at work in the operating room with ergonomically poor posture, plus a graphic artist's overlay depicting excessive curvature and rotation of the cervical, thoracic, and lumbar spine. (Image provided courtesy of the artist, Jordan Pietz, MA. © 2016 The University of Texas MD Anderson Cancer Center.)

Several other studies have examined foot mats in nonoperative, simulated settings.²¹⁻²³ Both Aghazadeh and colleagues²³ and Cook and coworkers²¹ found that foot mats improved subjective reports of pain, but no objective differences in muscle activity by electromyography were demonstrated. Cham and Refern²² also demonstrated changes in pain and discomfort ratings with different flooring surfaces, but only after 3 to 4 hours of standing; interestingly, lower-limb volume changes after periods of standing trended toward greater swelling on uncomfortable floors. We sought to expand upon previous studies by conducting a pilot study to prospectively evaluate outcomes after the use of foot mats during standard oncologic procedures (both open and laparoscopic), which has not previously been done. The primary outcome was change in leg volume (ie swelling), measured objectively with perometry. We hypothesized that intraoperative use of floor mats would improve postoperative symptom reports and reduce leg swelling.

METHODS

Occupation-Related Symptoms and Injury Survey

A systematic review of the surgical ergonomics literature was conducted, and all items from surveys included in these studies were compiled and reviewed. Items were then vetted by investigators experienced in survey design and analysis (JNC and KDC) using an iterative process.

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