Critical Review of *Assessing work-related musculoskeletal symptoms among otolaryngology residents*

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Project Overview

In this project, we will be measuring the neck flexion angles of otolaryngology residents and fellows during ear surgery. The neck flexion will be measured using two inertial measurement units (IMUs) and a neck angle calibration model. This data will be able to quantify the neck flexion of surgeons in different scenarios such as open, microscopic, and endoscopic cases and compare posture between physicians of distinct experience levels.

Paper Selection

The paper chosen for the critical review is titled *Assessing work-related musculoskeletal symptoms among otolaryngology residents* by Wong et al. This paper was chosen because it outlines the clinical problem that this project hopes to address and highlights key areas of interest for further research.

Background

The paper defines work-related musculoskeletal disorders (WMSDs) as injuries related to the action and environment of one's work. Studies published prior to this paper showed that many otolaryngologists experience some form of WMSD. These studies and the literature on this topic lacked identification of specific symptoms experienced by the surgeons and focused on practicing otolaryngologist. The goal of the study by Wong et al. was to survey otolaryngology residents and identify specific symptoms to better understand the typical WMSDs associated with the profession that are apparent early in one's surgical career.

Methods

Nordic Musculoskeletal Questionnaire (NMQ) was emailed to students in 30 otolaryngology residency programs from across the United States. A rough outline of the NMQ survey is as follows:

- Demographic Information
    - Age, Gender, Ethnicity, Height, Weight, Handedness, Post-Graduate Year (PGY), and Operation Hours/Week
- Musculoskeletal Symptoms
    - Anatomical Region (9)

        - Neck, Shoulders, Elbows, Wrists/Hands, Upper Back, Lower Back, Hips/Thighs, Knees, Ankles/Feel
    - Description
        - pain, stiffness, weakness, numbness, or other
    - Severity, Impact on Daily Living, if symptoms occurred within the past week, if symptoms caused the resident to stop operating or miss work, and if the resident believes their surgical training is the cause

The survey data was analyzed, and the distribution of responses was recorded. The experiment also conducted further statistical analysis to compare male and female residents (using two sample t-test) and residents below, near, and above average height (using Freeman-Halton extension of Fischer's exact test).

Results

Fig. 1 below shows the percentage of residents reporting symptoms in each of the anatomical regions in the NMQ. The most common symptom sites are the Neck (81%), Lower Back (55%), Shoulder (40%), and Upper Back (40%). **Fig. 2** shows the breakdown of the severity assessment for residents experiencing symptoms in each region. The proportion of residents experiencing severe symptoms is greatest in Elbows. The most common symptoms reported were neck stiffness (71.6%), neck pain (61.7%), lower back pain (48.2%), and lower back stiffness (46.8%).

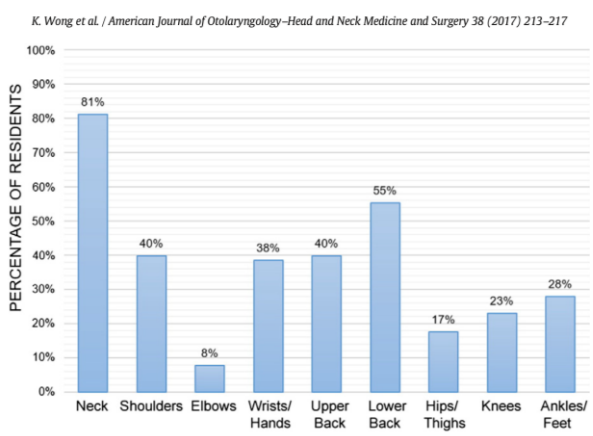

Figure1. Musculoskeletal symptoms. Prevalence of musculoskeletal symptoms by anatomic region.

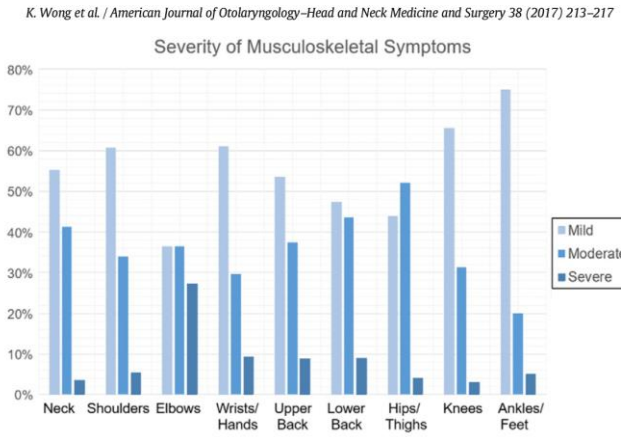

Figure2. Symptom severity. Severity of musculoskeletal symptoms by anatomic region.

Fig. 3 shows the residents report that symptoms are mostly attributed to surgical training in almost all categories aside from Hips/Thighs and Knees. The category that has the highest disparity in attributing the symptoms to surgical training is Neck (87% vs 13%) followed by Upper Back (81% vs 19%) and Shoulders (72% vs 28%). Overall, 83.7% of residents attributed their symptoms to surgical training.

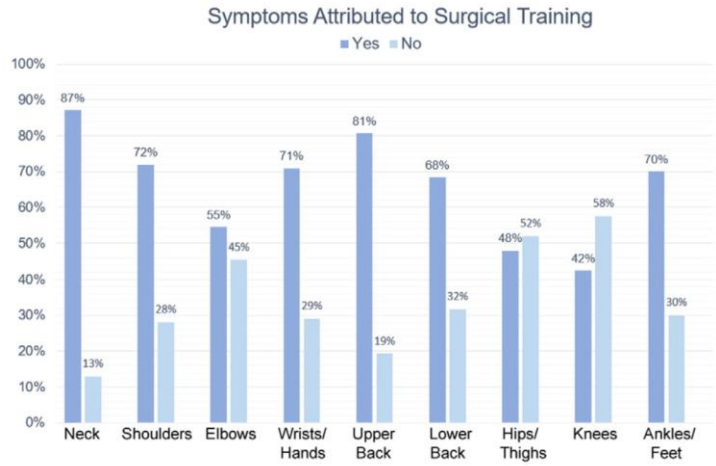

Figure3. Surgical training as a cause for symptoms. Percentage of residents who believed their musculoskeletal symptoms were caused by their surgical training, stratified by anatomic region.

76.6% of residents stated that they experienced symptoms within the past week, 6.4% missed work due to symptoms, and 16.3% had to stop partway through an operation due to symptoms. Women were more likely to experience neck and wrist/hand pain than men, however, there was no statistical significance for height.

Discussion & Conclusion

The results of this study are consistent with previous findings among practicing otolaryngologists. 24% of consultants reported neck pain, 19% reported back pain, and 29% reported both neck and back pain for an overall prevalence of 72%. The result indicated that musculoskeletal symptoms were also common among resident otolaryngologists. Physical symptoms were identified in multiple body regions and in a pattern similar to findings in attending otolaryngologists. The neck and back were also the most common areas affecting residents according to Wong's study.

Multiple risk factors for work-related musculoskeletal disorders can decrease day-to-day work of surgeons including concentrated hand or wrist motions, strained body positions, and extended periods of stranding. Some of the procedures performed by otolaryngologists may also promote maladaptive behavior that increases the risk for injury such as repetitive motions or craned necks during microscopic procedures.

Preliminary results demonstrate a high level of work-related musculoskeletal symptoms among otolaryngology residents. For some residents, symptoms were severe enough to directly impact training. And for both genders, investing in a safe work environment may not only decrease the risk for future musculoskeletal injury, but also improve the quality of surgical training for residents. Therefore, teaching concepts of proper operating ergonomics is necessary during residency which is an ideal time in one's career, and increased efforts should be made to establish safer work environment and promote resident awareness of this important topic.

The results of the study have some limitations. One was the low survey response rate (34.7%). Response bias was also a potential concern: residents who experienced musculoskeletal symptoms may have stronger opinions and be more likely to respond. Finally, their study only included residents training in the United States, which limits the ability to generalize their finding to residents training in other countries.

Project Insights

Increased emphasis on surgical ergonomics is necessary to improve workspace safety and prevent future injury. The paper provides insights on how the neck flexion angle is important as a part of operating ergonomics as the neck was a key region where most injury occurred in otolaryngology residents. The awareness of ergonomics should be built during surgical training for residents and a model to capture and evaluate surgeon's posture is more than necessary to reduce potential work-related musculoskeletal disorders. Here are several insights that our teams can learn from this paper:

- Dividing the surgery into different phases, computing the mean and standard deviation of data in those phases and discussing the severity of each phase, can contribute to a better identification in a purpose of teaching concepts of ergonomics.

- Besides neck flexion angle, angles in other parts of the body such as back, elbow and shoulder are also effective to show operating stressfulness. Comparison between back angle, elbow angle and shoulder angle in both microscopic and endoscopic surgical scenarios can place more emphasis in surgical ergonomics, which can be a potential area that our future study explores.

- The ergonomic issues faced by surgeons begins early in training, so early intervention is the best way to combat future risk and disability.

References

Wong, K., Grundfast, K. M., & Levi, J. R. (2017). Assessing work-related musculoskeletal symptoms among otolaryngology residents. *American journal of otolaryngology*, *38*(2), 213–217. https://doi.org/10.1016/j.amjoto.2017.01.013