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Hand and Wrist Issues in Orthopedic Surgeons - a Pilot Study

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ABSTRACT

Background/Aim: Overload of the hand and wrist are inherent to any occupation that includes manual work and holds true for surgical specialties in medicine. This pilot study evaluated hand/wrist injuries/ issues in a cohort of orthopaedic surgeons. Since orthopaedic surgery requires handling of tools and limbs that can be heavy, we hypothesized that there would be a significant amount of hand injuries/issues.

Methods: A modification of the Standardized Nordic Questionnaire (anonymous survey) was distributed through Research Electronic Data Capture (REDCap). The questionnaire evaluates subject characteristics such as age and years in practice as well the existence of hand/wrist issues.

Results: Hand injuries were common in orthopaedic surgeons (55%), and more common in female respondents (67%). A low BMI was associated with female gender (p=0.04) and prevalence of hand issues (p=0.01). There were no differences between light and heavy orthopaedic subspecialties in the number of injuries reported. Increased age and career length increased the likelihood of hand/wrist issues and issues were more common in the dominant hand p=0.65. Ninety-eight percent of those experiencing pain did not report their issues to their employer.

Conclusions: This pilot study supports small hand-size, female gender, and low BMI as predisposing to the development of hand injuries/conditions in surgery and is in tandem with the literature. Further study is needed but it is possible that adapting instruments to smaller-handed surgeons, may help address some issues that exist today in surgery and orthopaedic surgery specifically.

Keywords: hand; hand size; orthopedic surgeons; problems; wrist.

Introduction

Hazards and overload of the hand and wrist are inherent to any occupation that includes manual work. While as surgeons, we treat many work-related hand and wrist conditions, we rarely evaluate those injuries and conditions that stem from our own occupation.

Though studies have evaluated certain aspects of surgery, few studies evaluate orthopaedic surgery and the relationship to hand and wrist conditions. Multiple studies have found hand and wrist issues in surgeons of various surgical specialties: A study evaluating musculoskeletal pain in gynecologists found that wrist/hand pain was prevalent (60.9%), while female surgeons were twice as likely to have pain as male surgeons[1]. Another study evaluating musculoskeletal pain in pediatric surgeons focused on high body mass index (BMI) and poor physical condition[2,3]. In a study reviewing plastic surgeons, self-reported injury was found to be more prevalent in surgery than in other, labor-intensive populations. The sampled surgeons appeared to be younger than the general surgery workforce, underscoring the need for a formal, multicenter assessment of occupational injury in surgeons[4].

Specifically, laparoscopic and arthroscopic surgical equipment is not manufactured for ergonomic suitability and these have been shown to be a cause of musculoskeletal disorders in surgeons[5]. It has been demonstrated that laparoscopic instruments suffer from ergonomically inadequate handle designs and inefficient handle to tip force transmission, which lead to surgeon fatigue, discomfort, and hand paresthesias[6]. It is also possible that one of the risk factors during laparoscopic surgery, especially for neck/shoulder problems and visual disturbances includes beyond ergonomic factors, surgery factors such as the size of the incision and as surgeon-related factors[7]. Hand size has been found to be a significant determinant of difficulty using laparoscopic surgical instruments. Specifically, individuals using glove sizes 6.5 or smaller experience significantly more difficulty using common laparoscopic instruments, and in particular laparoscopic staplers[8]. Addressing these issues, Alaqueel et al. described guidelines from industry for orthopaedic surgery that include maintaining a neutral posture and joint alignment and working with the appropriate hand tools. They concluded that optimizing the occupational environment and utilizing well-established ergonomic principle from industry is both feasible and practical in the operating room to decrease the incidence of musculoskeletal injuries reported as 2/3rds of all surgeons during their career[3].

A study by Yakkanti et al. found high rates of work-related injuries to the back and wrist/hand in orthopaedic surgeons. Eighty-five percent of these were carpal tunnel syndrome[9]. A better understanding of the causes of hand and wrist pain in orthopaedic surgeons is likely to improve the ability to prevent these from occurring, thus decreasing disability associated with multiple surgical professions.

We initiated a pilot survey, using a validated questionnaire, to investigate the prevalence of orthopaedic problems in our department. We hypothesized that a significant percentage of orthopaedic surgeons will have or have had hand problems related to their work and that we will find trends in work and/or subject characteristics that will enable a future more focused study to determine causes of work-related hand issues in orthopaedic surgery.

Methods:

A modification of the Standardized Nordic Questionnaire (anonymous survey) was distributed through Research Electronic Data Capture (REDCap). (Figure 1) This questionnaire was distributed to all orthopaedic surgeons in our department as well as to various other groups including a pediatric orthopaedic group and a forum for women in orthopaedics, via direct email. Since the number of female orthopaedic surgeons is so small, we specifically targeted a forum for women surgeons. Recipients were prompted twice

to submit a response. Ninety-three responses were collected of which seven were excluded for incompleteness. The remaining 87 responses were used for analysis. Since this study is based on an anonymous survey, in discussion with our institutional review board (IRB) it was deemed unnecessary to obtain IRB approval or consent prior to performance.

Figure 1: The online questionnaire.

Field Label	Choices, Calculations, OR Slider Labels
Study ID	
Years in Practice	0-10 years | 11-20 years | 21-30 years | 31-40 years | Greater than 40 years
Age (years)	30-39 | 40-49 | 50-59 | 60-69 | 70-79 | 80 or above
Gender	Female | Male
What fellowship(s) have you completed? (check all that apply)	Trauma | Spine | Arthroplasty | Sports | Pediatrics | Oncology | Hand | Other
If "Other" was selected, please indicate the fellowship completed.	*Free response*
Height (in)	*Free response*
Weight (lbs)	*Free response*
BMI	round(([weight]/(([height])^(2))*703), 1)
Are you right-handed or left-handed?	Right-handed | Left-handed | Both right-handed and left-handed
Have you ever had trouble (ache, pain, discomfort) in your hand/wrist?	Yes | No
Is your hand/wrist trouble (ache, pain, discomfort) on your dominant side?	Yes | No | It affects both sides
At the time of initial onset of your hand/wrist trouble, what was your age?	*Free response*
Have you ever been hospitalized because of hand/wrist trouble?	Yes | No
Have you ever had to change jobs or duties (even temporarily) because of hand/wrist trouble?	Yes | No
Have you had hand/wrist trouble (ache, pain, discomfort) at any time during the last 12 months?	Yes | No
Have you had hand/wrist trouble (ache, pain, discomfort) at any time during the last month (4 weeks)?	Yes | No
Have you had hand/wrist trouble (ache, pain, discomfort) today?	Yes | No
What is the total length of time that you have had hand/wrist trouble during the last 12 months?	0 days | 1-7 days | 8-30 days | More than 30 days, but not every day | Every day
What is the total length of time that hand/wrist trouble has prevented you from doing your normal work (at home or away from home) during the last 12 months?	0 days | 1-7 days | 8-30 days | More than 30 days
Has hand/wrist trouble caused you to reduce your work activity (at home or away from home) during the last 12 months?	Yes | No
Have you taken sick leave from work because of hand/wrist trouble during the last 12 months at any time?	Yes | No
Has hand/wrist trouble caused you to reduce your leisure activity during the last 12 months?	Yes | No
Have you been seen by a doctor, physiotherapist, chiropractor, or other such person because of hand/wrist trouble during the last 12 months?	Yes | No
Have you taken medication because of hand/wrist trouble during the last 12 months at any time?	Yes | No
Do you think your hand/wrist trouble is related your present work?	The symptoms are solely related to present work. | The symptoms are partly related to present work, partly not. | The symptoms are solely related to other factors than the present work.
Have you reported your hand/wrist trouble to your employer?	Yes | No | Don't want to answer
What was your reason for not reporting your hand/wrist trouble to your employer? (Data will be reported in combined results. No individual participant or employer will be identified in any report.)	*Free response*
Comments	*Free response*

To determine the factors that most influenced the risk of hand issues, several categories were created. The various subspecialties of orthopedic surgery were grouped into the categories of "Heavy" (including general orthopedics, trauma, spine, arthroplasty, sports medicine, and oncology) and "Light" (including pediatric orthopaedics, hand surgery, foot & ankle surgery, and shoulder). For this study, "issues" were defined as any occurrence of hand pain. Severity was graded as mild (no impact on work or leisure), moderate (any amount of lost work or leisure), or severe (requiring hospitalization).

STATISTICAL ANALYSIS:

Univariate statistics were reported for all variables. Mean and standard deviation were calculated for continuous variables. Count and proportion were reported for categorical variables. To determine differences in hand outcomes between men and women, a chi-square test for independence was calculated.

All analyses were two-tailed and set at the 0.10 level. A higher alpha threshold of 0.10 was used for significance since this is a pilot study. By nature, pilot studies are small-scale, preliminary studies that are conducted to determine feasibility to conduct a robust research project. Therefore, due to the small sample size of this study and the novel nature of pilot studies, a higher alpha level was deliberately set to identify potential exposures to differences in hand outcomes between men and women. The aim is to indicate potential exposures that can be fully analyzed in future studies.

Results:

Table 1 describes the population characteristics as well as the percentage of respondents with hand issues. Hand injuries were common in orthopaedic surgeons overall and more common among the 24 female-identifying respondents (67%). There were no statistically significant differences between light and heavy orthopaedic subspecialties in the number of injuries reported.

Table 1: Respondent characteristics:

Gender	N (%)	# Hand Issues (%)
Male	62 (71)	30 (48)
Female	24 (28)	16 (67)
Declined to Answer	1 (1)	1 (100)
Total	87 (100)	47 (54)
Age		
30-39	13 (15)	5 (38)
40-49	34 (39)	18 (53)
50-59	22 (25)	15 (68)
60-69	13 (15)	5 (38)
70-79	4 (5)	3 (75)
80+	1 (1)	1 (100)
BMI		
<18.5	0 (0)	0 (0)
18.5 – 24.9	32 (37)	17 (53)
25 – 29.9	38 (44)	19 (53)
>29.9	10 (11)	7 (70)
Declined to Answer	7 (8)	3 (43)
Career Stage		
<10 Years	19 (22)	10 (53)

Gender	N (%)	# Hand Issues (%)
10-20 Years	24 (28)	13 (54)
20+ Years	44 (51)	24 (55)
Subspecialty		
General	8 (9)	3 (38)
Trauma	14 (16)	9 (64)
Spine	6 (7)	4 (67)
Arthroplasty	6 (7)	2 (33)
Sports	9 (10)	5 (56)
Pediatric	13 (15)	8 (62)
Oncology	2 (2)	1 (50)
Hand	23 (26)	12 (52)
Foot/Ankle	5 (6)	3 (60)
Shoulder	1 (1)	0 (0)

Increased age and increased career length trended towards an association with an increased likelihood of hand issues. Surgeons who were older or who were more advanced in their career were also more likely to report hand issues, p=0.56. The rates of problems experienced for early, mid, and late career surgeons were 53%, 54%, and 55%, respectively, and these issues were most often in the dominant hand p=0.65.

A low BMI was found to be significantly associated with female gender (p=0.04) and the prevalence of hand issues (p=0.01). Table 2

Table 2: Body mass index (BMI) associations with a p value <0.1

		BMI				
	Response	N (%)	18.5 – 24.9 (%)	25 – 29.9 (%)	>30 (%)	P value
Gender (%)	*Male*	62 (72.1)	20 (62.5)	33 (86.8)	6 (60.0)	0.040
	Female	24 (27.9)	12 (37.5)	5 (13.2)	4 (40.0)	
Have you ever been hospitalized because of hand/wrist trouble?	*No*	42 (91.3)	16 (100.0)	18 (90.0)	5 (71.4)	0.094
	Yes	4 (8.7)	0 (0.0)	2 (10.0)	2 (28.6)	
Have you been seen by a doctor, physiotherapist, chiropractor or other such person because of hand/wrist trouble during the last 12 months?	*No*	38 (80.9)	16 (94.1)	17 (85.0)	3 (42.9)	0.011
	Yes	9 (19.1)	1 (5.9)	3 (15.0)	4 (57.1)	
Have you reported your hand/wrist trouble to your employer?	*No*	46 (97.9)	17 (100.0)	20 (100.0)	6 (85.7)	0.067
	Yes	1 (2.1)	0 (0.0)	0 (0.0)	1 (14.3)	
Years in Practice	*<10 years*	19 (21.8)	11 (34.4)	7 (18.4)	0 (0.0)	0.078
	10-20 years	24 (27.6)	10 (31.2)	8 (21.1)	3 (30.0)	
	20+ years	44 (50.6)	11 (34.4)	23 (60.5)	7 (70.0)	

Ninety-eight percent of those experiencing pain said they did not report their issues to their employer. Respondents were given a free-response section in which to explain their reasoning; 37 surgeons gave a reason why their hand pain was not reported (Figure 2).

Figure 2: Open ended answers to "why did you not report your hand/wrist issue?"

What was your reason for not reporting your hand/wrist trouble to your employer?	
Subject 27	*It is my livelihood and part of the occupation*
Subject 38	*"I don't pay attention to it, [it's] part of the job*
Subject 60	*"I managed to work with the pain*
Subject 67	*"It wasn't going to change anything "*
Subject 94	*"Because I don't think anything will be done"*

Figure 2: Selected responses from surgeons asked to give their reasons for not reporting issues to their employer.

Discussion:

A purpose of this pilot study was to try and identify specific surgeon and/or occupational characteristics that predispose surgeons to hand/wrist injury. Orthopaedic surgeons perform manual tasks that may place significant forces on the hands and wrists. As opposed to other surgical specialties, the saws, drills, and mallets in orthopaedic surgery are often large and heavy. Extended tool use, repetitive movements, and the varying amounts of force needed to deal with the different tissues during an operation may lead to overuse injuries. Furthermore, the high stakes of surgical work may lead all surgeons to deprioritize their own comfort. While this is sometimes necessary, over a career, these ergonomic issues can cause hand/wrist problems to accumulate and worsen. Our survey results showed that hand/wrist injuries were prevalent among all orthopaedic surgeons. This is in tandem with the study by Yakkanti et al. that found hand and wrist injuries to be the most common musculoskeletal issues (39.8%)[9].

The study also identified some subgroups that seemed to be more prone to injuries. Specifically, low BMI and female gender (which were significantly associated with each other) were associated with a higher prevalence of hand /wrist injuries. Multiple studies have found significant relationships between gender, hand size, grip strength and BMI[10,11]. Other studies have found that female gender and smaller hand size in surgeons caused a higher incidence of injuries and hand problems. One study found consistently higher values in gripping and grappling (sports such as jujitsu) for males compared to females ($p < 0.001$)[12]. Grip strength, which is related to gender as well as to BMI and hand size increased the difficulty with using tools in laparoscopic surgery[13]. Another study found gender related differences in the function of the flexor carpi ulnaris (FCU) during submaximal hand grip[10,13]. It is possible these surgeon characteristics together with the heavy orthopedic surgical tools cause an increased tendency of female and smaller individual orthopaedic surgeons to develop hand and wrist problems. It is likely that in some of the cases the common denominator is hand size.

Despite this relatively high occurrence, a low report rate was documented. This is also in tandem with the Yakkanti article[9]. The reasons given by the surveyed surgeons may reflect work culture in surgery in general or in orthopaedics specifically. However, the sample size is too limited to reach any conclusions. This work culture when added to the increased technical difficulty of a smaller individual may form an easily "correctable" issue for residents as well as attendings.

While multiple studies have highlighted both the current lack of and existing need for diversity especially in orthopaedic surgery, perhaps "leveling the playing field" can be more easily achieved by adapting the tools used in the operating room to more diverse hand sizes and grip strengths[14].

This was a pilot study (therefore demonstrated trends more than significant differences). It should be used to direct future studies using the following questionnaires towards those characteristics that trended towards significance. This survey did not address the specific features of the hand/wrist issues (bony versus tendinous versus ligamentous, one -time injury versus overuse etc..). Furthermore, the survey only evaluated orthopaedic surgeons. Despite many similarities between disciplines (such as arthroscopic and laparoscopic surgeries), widening the field of specialties that are being studied is necessary. Further study should also account for possible multiple confounding factors such as age, that affects the prevalence of arthritis, or cultural characteristics of certain surgical specialties such as participation in sports and injuries sustained outside of the operating theater[15-17].

Conclusions:

In summary, this study suggests that since tools are not often ergonomically suited to smaller hands, most specifically in orthopaedic surgery, increased hand and wrist related problems may be seen in smaller individuals. Though this is probably only one aspect of hand injuries/conditions in surgeons, addressing this issue may be a practical way to promote career longevity in surgeons. Additional study can aid in a better understanding of the scope and detail of hand issues allowing us to address specific problems more directly.

Conflict of Interest:

The authors have no conflicts of interest to declare.

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References:

1. Adams SR, Hacker MR, McKinney JL, Elkadry EA, Rosenblatt PL. Musculoskeletal pain in gynecologic surgeons. *J Minim Invasive Gynecol*. Sep-Oct 2013 ;20(5):656-60. doi:10.1016/j.jmig.2013.04.013

2. Akbiyik F, Uysal O, Firat T, Bek N. Evaluation of work-related musculoskeletal problems in pediatric surgeons. *Pediatr Surg Int*. Oct 2021;37(10):1333-1338. doi:10.1007/s00383-021-04928-9

3. Alaqeel M, Tanzer M. Improving ergonomics in the operating room for orthopaedic surgeons in order to reduce work-related musculoskeletal injuries. *Ann Med Surg (Lond)*. Aug 2020;56:133-138. doi:10.1016/j.amsu.2020.06.020

4. Capone AC, Parikh PM, Gatti ME, Davidson BJ, Davison SP. Occupational injury in plastic surgeons. *Plast Reconstr Surg*. May 2010;125(5):15 55-1561. doi:10.1097/PRS.0b013e3181d62a94

5. Wyatt RW, Lin CC, Norheim EP, Przepiorski D, Navarro RA. Occupation-related Cervical Spine Disease in Orthopaedic Surgeons. *J Am Acad Orthop Surg*. Sep 1 2020;28(17):730-736. doi:10.5435/JAAOS-D-19-00834

6. Berguer R. Surgical technology and the ergonomics of laparoscopic instruments. *Surg Endosc*. May 1998;12(5):458-62. doi:10.1007/s004649900705

7. Alhusuny A, Cook M, Khalil A, Xie Y, Johnston V. Neck/Shoulder Problems and Visual Disturbances Among Surgeons: A Scoping Review. *J Surg Res*. Mar 2020;247:413-428. doi:10.1016/j.jss.2019.09.064

8. Berguer R, Hreljac A. The relationship between hand size and difficulty using surgical instruments: a survey of 726 laparoscopic surgeons. *Surg Endosc*. Mar 2004;18(3):508-12. doi:10.1007/s00464-003-8824-3

9. Yakkanti RR, Sedani AB, Syros A, Aiyer AA, D'Apuzzo MR, Hernandez VH. Prevalence and Spectrum of Occupational Injury Among Orthopaedic Surgeons: A Cross-Sectional Study. *JB JS Open Access*. Jan-Mar 2023;8(1)doi:10.2106/JBJS.OA.22.00083

10. Cruz-Montecinos C, Antunez-Riveros MA, Tapia C, et al. Gender differences on effects of forearm rotation on compressive stiffness of flexor carpi ulnaris during submaximal handgrip contractions. *J Anat*. Nov 2023;243(5):886-891. doi:10.1111/joa.13914

11. Pua YH, Tay L, Clark RA, et al. Associations of height, weight, and body mass index with handgrip strength: A Bayesian comparison in older adults. *Clin Nutr ESPEN*. Apr 2023;54:206-210. doi:10.1016/j.clnesp.2023.01.028

12. Escobar-Molina R, Cuevas-Laguna M, Chirosa-Rios IJ, Merino-Fernandez M, Chirosa-Rios LJ, Franchini E. Analysis of grip specificity on force production in grapplers and its effect on bilateral deficit grip specificity and bilateral deficit in force production among grapplers. *Front Sports Act Living*. 2023;5:1190369. doi:10.3389/fspor.2023.1190369

13. Hislop J, Orth D, Tirosh O, Isaksson M, Hensman C, McCormick J. Does surgeon sex and anthropometry matter for tool usability in traditional laparoscopic surgery? A systematic review and meta-analysis. *Surg Endosc*. Sep 2023; 37(9):6640-6659. doi:10.1007/s00464-023-10228-1

14. Leal J, Clifford AL, Anastasio AT, Dymtruk M, Roach RP. Diversity Within the Field of Orthopedic Sports Medicine: A Systematic Review. *JBJS Rev*. Oct 1 2023;11(10)doi:e23.00134 10.2106/JBJS.RVW.23.00134

15. Mickle AM, Tanner JJ, Holmes U, 3rd, et al. Applying evidence-based cross-disciplinary concepts helps to explain the heterogeneity in pain, function, and biological measures in individuals with knee pain with/at risk of osteoarthritis. *Pain Rep*. Feb 2025;10(1):e1225. doi:10.1097/PR9.0000000000001225

16. Zimmerman M, Nilsson P, Rydberg M, Dahlin L. Risk of hand and forearm conditions due to vibrating hand-held tools exposure: a retrospective cohort study from Sweden. *BMJ Open*. Jun 18 2024;14(6):e080777. doi:10.1136/bmjopen-2023-080777

17. Ganhewa AD, Seth I, Wu R, et al. Exploring Age-Related Variations in Carpal Bone Volume: Implications for Clinical Practice and Anatomical Understanding. *Hand (N Y)*. Apr 12 2024:15589447241242830. doi:10.1177/15589447241242830

