### CONTENTS

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>411</td>
<td>Update in combined musculoskeletal and vascular injuries of the extremities</td>
<td>Stefanou N, Arnaoutoglou C, Papageorgiou F, Matsagkas M, Varitimidis SE, Dailiana ZH</td>
</tr>
<tr>
<td>427</td>
<td>Coronal plane deformity around the knee in the skeletally immature population: A review of principles of evaluation and treatment</td>
<td>Coppa V, Marinelli M, Procaccini R, Falcioni D, Farinelli L, Gigante A</td>
</tr>
<tr>
<td>444</td>
<td>Insufficient lateral stem contact is an influencing factor for significant subsidence in cementless short stem total hip arthroplasty</td>
<td>Suksathien Y, Chuvanichanon P, Tippimanchai T, Sueajui J</td>
</tr>
<tr>
<td>454</td>
<td>Distal femur complex fractures in elderly patients treated with megaprosthesis: Results in a case series of 11 patients</td>
<td>Zanchini F, Piscopo A, Cipolloni V, Fusini F, Cacciaquoti S, Piscopo D, Pripp C, Nasto LA, Pola E</td>
</tr>
<tr>
<td>465</td>
<td>Prevalence and factors of work-related musculoskeletal disorders among hand surgeons</td>
<td>Alqahtani SM, Alzahrani MM, Bicknell R, Pichora D</td>
</tr>
<tr>
<td>472</td>
<td>What factors are important to new patients when selecting an orthopedic oncologist?</td>
<td>Gusho CA, Patel V, Lee L, Blank AT</td>
</tr>
<tr>
<td>481</td>
<td>Anterior vertebral body tethering for idiopathic scoliosis in growing children: A systematic review</td>
<td>Bizzoca D, Piazzolla A, Moretti L, Vicenti G, Moretti B, Solarino G</td>
</tr>
<tr>
<td>494</td>
<td>Effect of non-steroidal anti-inflammatory drugs on fracture healing in children: A systematic review</td>
<td>Stroud S, Katyal T, Gornitzky AL, Swarup I</td>
</tr>
<tr>
<td>503</td>
<td>Prosthetic joint infection of the hip and knee due to Mycobacterium species: A systematic review</td>
<td>Santosso A, Phatama KY, Rhatomy S, Budhiparama NC</td>
</tr>
<tr>
<td>515</td>
<td>Prophylactic fixation of the unaffected contralateral side in children with slipped capital femoral epiphysis seems favorable: A systematic review</td>
<td>Vink SJC, van Strafen RA, Moerman S, van Bergen CJA</td>
</tr>
</tbody>
</table>
CASE REPORT

528  Intramedullary bone pedestal formation contributing to femoral shaft fracture nonunion: A case report and review of the literature
    Pasque CB, Pappas AJ, Cole Jr CA

538  Extensive adhesion formation in a total knee replacement in the setting of a gastrointestinal stromal tumor: A case report
    Mitchell S, Lee A, Stenquist R, Yatsosky II D, Mooney ML, Shendge VB
ABOUT COVER
Editorial Board Member of World Journal of Orthopedics, Farid Amirouche, MS, PhD, Professor, Department of Orthopedics Surgery, University of Illinois at Chicago, Chicago, IL 60612, United States. amirouch@uic.edu

AIMS AND SCOPE
The primary aim of World Journal of Orthopedics (WJO, World J Orthop) is to provide scholars and readers from various fields of orthopedics with a platform to publish high-quality basic and clinical research articles and communicate their research findings online.

WJO mainly publishes articles reporting research results and findings obtained in the field of orthopedics and covering a wide range of topics including arthroscopy, bone trauma, bone tumors, hand and foot surgery, joint surgery, orthopedic trauma, osteoarthropathy, osteoporosis, pediatric orthopedics, spinal diseases, spine surgery, and sports medicine.

INDEXING/ABSTRACTING
The WJO is now abstracted and indexed in PubMed, PubMed Central, Emerging Sources Citation Index (Web of Science), Scopus, Reference Citation Analysis, China National Knowledge Infrastructure, China Science and Technology Journal Database, and Superstar Journals Database. The 2021 edition of Journal Citation Reports® cites the 2020 Journal Citation Indicator (JCI) for WJO as 0.66. The WJO’s CiteScore for 2020 is 3.2 and Scopus CiteScore rank 2020: Orthopedics and Sports Medicine is 87/262.

RESPONSIBLE EDITORS FOR THIS ISSUE
Production Editor: Ying-Yi Yuan; Production Department Director: Xiang Li; Editorial Office Director: Jin-Lei Wang.

NAME OF JOURNAL
World Journal of Orthopedics

ISSN
ISSN 2218-5836 (online)

LAUNCH DATE
November 18, 2010

FREQUENCY
Monthly

EDITORS-IN-CHIEF
Massimiliano Leigheb

EDITORIAL BOARD MEMBERS
http://www.wjgnet.com/2218-5836/editorialboard.htm

PUBLICATION DATE
May 18, 2022

COPYRIGHT
© 2022 Baishideng Publishing Group Inc

INSTRUCTIONS TO AUTHORS
https://www.wjgnet.com/bpg/gerinfo/204

GUIDELINES FOR ETHICS DOCUMENTS
https://www.wjgnet.com/bpg/GerInfo/287

GUIDELINES FOR NON-NATIVE SPEAKERS OF ENGLISH
https://www.wjgnet.com/bpg/gerinfo/240

PUBLICATION ETHICS
https://www.wjgnet.com/bpg/gerinfo/288

PUBLICATION MISCONDUCT
https://www.wjgnet.com/bpg/gerinfo/208

ARTICLE PROCESSING CHARGE
https://www.wjgnet.com/bpg/gerinfo/242

STEPS FOR SUBMITTING MANUSCRIPTS
https://www.wjgnet.com/bpg/gerinfo/239

ONLINE SUBMISSION
https://www.f6publishing.com

© 2022 Baishideng Publishing Group Inc. All rights reserved. 7041 Koll Center Parkway, Suite 160, Pleasanton, CA 94566, USA
E-mail: bpgoffice@wjgnet.com  https://www.wjgnet.com
Observational Study

Prevalence and factors of work-related musculoskeletal disorders among hand surgeons

Saad M Alqahtani, Mohammad M Alzahrani, Ryan Bicknell, David Pichora

Saad M Alqahtani, Mohammad M Alzahrani, Department of Orthopaedics, Imam Abdulrahman Bin Faisal University, Dammam 34212, Saudi Arabia
Ryan Bicknell, David Pichora, Department of Orthopaedics, Queens University, Kingston K7L 3N6, Ontario, Canada

Corresponding author: Mohammad M Alzahrani, FRCS, MBBS, MSc, Assistant Professor, Department of Orthopaedics, Imam Abdulrahman Bin Faisal University, King Faisal Road, Dammam 34212, Saudi Arabia. mmalzahrani@iau.edu.sa

Abstract

BACKGROUND
The nature of tasks required by hand surgeons require both forceful and repetitive maneuvers, thus subjecting these surgeons to the risk of musculoskeletal (MSK) injuries during their years in practice.

AIM
To assess the prevalence, characteristics and impact of MSK disorders among hand surgeons.

METHODS
A modified version of the physical discomfort survey was sent to surgeons who were members of the American Society for Surgery of the Hand via e-mail. The collected data were analyzed using descriptive statistics, one-way analysis of variance, and Fisher’s exact test. P values of < 0.05 were considered statistically significant.

RESULTS
Of the 578 respondents, 60.4% reported that they had sustained a work-related MSK injury, of which the most common diagnoses were lateral elbow epicondylitis (18.7%), low back pain (17.1%) and carpal tunnel syndrome (15.6%). Among those that reported an injury, 73.1 % required treatment and 29.2 % needed time off work as a direct result of their injury. The number of work-related injuries incurred by a surgeon increased significantly with increasing age (P < 0.003), increasing years in practice (P < 0.001) and higher case load (P < 0.05).

CONCLUSION
To our knowledge this study is the first of its kind to assess MSK injuries
sustained by Hand surgeons with a high incidence. These results should increase awareness on this aspect and fuel future studies directed at preventing these types of work-related injuries, thus minimizing the financial and psychological burden on these surgeons and the healthcare system.

**Key Words:** Hand; Surgeon; Prevalence; Musculoskeletal disorders; Occupational injuries

©The Author(s) 2022. Published by Baishideng Publishing Group Inc. All rights reserved.

**Core Tip:** Work-related musculoskeletal injuries are a common occurrence during the years of practice of hand surgeons. The most common diagnoses were lateral elbow epicondylitis, low back pain and carpal tunnel syndrome. Awareness and knowledge of these injuries can minimize the financial and psychological burden on both surgeons and the healthcare system.

**INTRODUCTION**

Occupational injuries have gained recent attention in the medical literature, with studies exploring the prevalence of these injuries and possible predisposing factors. While all physicians are at risk of sustaining these injuries, surgeons have been identified as a high-risk group[1-6].

Musculoskeletal (MSK) disorders have been identified as a common occupational risk for surgeons, which has been referred to as “an impending epidemic”[1]. Their risk of occurrence increases especially when the surgeon is involved in tasks requiring repetitive and forceful movements, as it has been found that the prevalence of these injuries was more than 60% in practicing orthopaedic surgeons of different subspecialties[3-5,7-9]. These injuries involved multiple MSK regions, including the lower back, elbow and wrist, thus requiring a large cohort of these injured surgeons to take time off work as a direct result of their sustained injuries.

Awareness of these MSK disorders and improvements in operative room ergonomics may have a substantial effect on the prevention of their occurrence[10-12]. Unfortunately, this effect isn’t evident from the most recent literature, possibly due to the difficulty in applying some of the proposed ergonomical alterations and recommendations in the operative field[10,13,14].

We conducted a study exploring prevalence of work-related MSK disorders among hand surgeons, with a goal to identify specific factors predisposing to these injuries and their impact on the surgeon’s practice. Also, we aimed from this study to increase awareness of these types of injuries both to the practicing surgeon and members of the healthcare system in general.

**MATERIALS AND METHODS**

Members of the American Society for Surgery of the Hand were sent a modified version of the physical discomfort survey via e-mail. The initial email was sent in June 2016, followed by a reminder email in December 2017, and survey collection was closed by June 2017.

Questions pertaining to the surgeons general demographics (e.g., age, gender, hand-dominance, type of practice, number of years in practice and annual caseload), in addition to questions exploring work related MSK injuries were included in the survey. The explored MSK injuries were divided into anatomical regions, including neck, shoulder, elbow/forearm, wrist/hand, hip, knee, foot and ankle, low back. In addition, participants were asked about both treatment required and time off work required due to the reported injuries, if any.

**Statistical analyses**

The collected data was analyzed using descriptive statistics, one-way analysis of variance, and Fisher’s exact test using SPSS statistical package version 24 (SPSS Inc., Chicago, IL). P values of < 0.05 were considered statistically significant.
RESULTS

Five hundred and seventy-eight surgeons completed the survey, with a respondent rate of 16.5%. The majority of respondents were males (84.8%), while 15.2% were females. More than half of the responding surgeons were younger than 55 years, while most have been in practice less than 30 years (Figure 1A and B). The vast majority of surgeons were practicing in an academic, community or private institute.

Concerning work related injuries, 60.4% reported that they had sustained a work-related MSK injury (Table 1), of which the most common diagnoses were lateral elbow epicondylitis (18.7%), low back pain (17.1%) and carpal tunnel syndrome (15.6%) (Figure 2). The number of work-related injuries incurred by a surgeon increased significantly with increasing age ($P < 0.003$), increasing years in practice ($P < 0.001$) and higher case load ($P < 0.05$). No association was found between sustained injuries and sex, hand dominance, nor type of practice.

Among those that reported an injury, 73.1 % required treatment, of which 11.8% required surgical management only, while 31.5% required both surgical and medical management for their injuries (Table 2). The need to undergo treatment or take time off due to the injury was associated with increased number of injuries ($P < 0.001$). In addition, surgeons were more likely to receive surgical treatment when they were > 56 years of age ($P < 0.001$) or had been in practice for > 30 years ($P < 0.001$).

Of the respondents, 29.2% needed time off work as a direct result of their injury (Table 2). We also found that surgeons were more likely to require time off work when they were > 56 years of age ($P < 0.001$) or had been in practice for > 21 years ($P < 0.001$).

DISCUSSION

We assessed the prevalence of work-related musculoskeletal injuries sustained by hand surgeons during their career. We found that of those responding to a survey, a high proportion of these surgeons (60.4%) reported a musculoskeletal injury sustained during work. A number of previous studies have assessed this prevalence in different specialties, as Davis et al[3] reported a 44% prevalence of these work-related injuries in the general orthopaedic surgeon cohort. Specifically, Alqahtani et al[4,5] surveyed both the orthopaedic adult reconstructive and the orthopaedic trauma surgeon cohorts and found a similar prevalence of 66% in both studies. Alzahrani et al[7] found that 67% of the 402 orthopaedic pediatric surgeon respondents reported that they sustained a work-related MSK injury.

The most common injuries reported by the surveyed hand surgeons in our cohort were lateral epicondylitis (18.7%) and low back pain (17.1%). We also found a high prevalence of carpal tunnel syndrome which was reported by more than 15% of the respondents. These common pathologies were similar to the previously published studies in different specialities, as low back pain and elbow injuries were the most common reported injuries by the surveyed surgeons.

Increasing age and years in practice were associated with the number of reported injuries in our cohort. We also found that surgeons with a higher case load were more likely to report a work-related MSK injury. Alqahtani et al[5] and Alzahrani et al[7] also found that increasing age and number of years in practice were independently associated with the number of reported MSK injuries in both the orthopaedic trauma and pediatric surgeon populations. In a study of 183 orthopaedic adult reconstruction surgeons, age > 55, practicing for > 20 years and increased case load were found to be associated with requiring time off work due to the sustained injury, but they found that these variables were not associated with the number of reported injuries[4]. In our cohort we found similar results, as time off work was more likely in surgeons older than 56 years and surgeons who have been in practice

---

**Figure 1** Age distribution, distribution of years in practice among survey participants. A: Age distribution; B: Distribution of years in practice.
Table 1 Percentage of surveyed hand surgeons with disorders and their requirement of time off work according to sex, age, hand dominance, type of practice, number of institutes, years in practice and annual caseload, n (%)

<table>
<thead>
<tr>
<th></th>
<th>Number of respondents</th>
<th>Number of respondents with injuries</th>
<th>Number of Injured requiring time off work</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (yr)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 45</td>
<td>151</td>
<td>91 (60.3)</td>
<td>10 (6.6)</td>
</tr>
<tr>
<td>46-55</td>
<td>146</td>
<td>90 (61.6)</td>
<td>20 (13.7)</td>
</tr>
<tr>
<td>56-65</td>
<td>173</td>
<td>102 (59)</td>
<td>42 (24.3)</td>
</tr>
<tr>
<td>&gt; 65</td>
<td>108</td>
<td>66 (61.1)</td>
<td>30 (27.8)</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>490</td>
<td>292 (59.6)</td>
<td>87 (17.8)</td>
</tr>
<tr>
<td>Female</td>
<td>88</td>
<td>57 (64.8)</td>
<td>15 (17)</td>
</tr>
<tr>
<td><strong>Hand dominance</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>518</td>
<td>316 (61)</td>
<td>92 (17.8)</td>
</tr>
<tr>
<td>Left</td>
<td>60</td>
<td>33 (55)</td>
<td>10 (16.7)</td>
</tr>
<tr>
<td><strong>Type of practice</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic</td>
<td>171</td>
<td>111 (64.9)</td>
<td>33 (19.3)</td>
</tr>
<tr>
<td>Community</td>
<td>186</td>
<td>114 (61.3)</td>
<td>38 (20.4)</td>
</tr>
<tr>
<td>Private</td>
<td>182</td>
<td>99 (54.4)</td>
<td>27 (14.8)</td>
</tr>
<tr>
<td>Other</td>
<td>39</td>
<td>25 (64.1)</td>
<td>4 (10.3)</td>
</tr>
<tr>
<td><strong>Number of institutes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>544</td>
<td>329 (60.5)</td>
<td>98 (18.1)</td>
</tr>
<tr>
<td>&gt; 1</td>
<td>34</td>
<td>20 (58.8)</td>
<td>4 (11.8)</td>
</tr>
<tr>
<td><strong>Years in practice</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 10</td>
<td>145</td>
<td>86 (59.3)</td>
<td>9 (6.2)</td>
</tr>
<tr>
<td>11-20</td>
<td>135</td>
<td>85 (63)</td>
<td>20 (14.8)</td>
</tr>
<tr>
<td>21-30</td>
<td>175</td>
<td>103 (58.9)</td>
<td>38 (21.7)</td>
</tr>
<tr>
<td>&gt; 30</td>
<td>123</td>
<td>75 (61)</td>
<td>35 (28.5)</td>
</tr>
<tr>
<td><strong>Annual caseload</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 250</td>
<td>110</td>
<td>55 (50)</td>
<td>19 (17.3)</td>
</tr>
<tr>
<td>251-500</td>
<td>273</td>
<td>179 (65.6)</td>
<td>52 (19)</td>
</tr>
<tr>
<td>501-750</td>
<td>117</td>
<td>65 (55.6)</td>
<td>19 (16.2)</td>
</tr>
<tr>
<td>&gt; 750</td>
<td>78</td>
<td>50 (64.1)</td>
<td>12 (15.4)</td>
</tr>
</tbody>
</table>

for more than 21 years.

Identifying this high prevalence of MSK-injuries in practicing surgeons (who responded to the survey) is the first step in exploring factors that can be implemented to aid in reducing the risk of sustaining such injuries. Operative room ergonomics has been identified in recent studies as an area that requires significant improvement, especially in surgeon postures and movements\[10,14,15\]. These include the use of specific body supports to improve posture and lower extremity compressive stockings to decrease the edema especially in long anticipated cases\[15,16\]. In addition, making use of certain power tools for screw insertions can help decrease the burden of the repetitive forceful movements required in this this surgeon population\[8\]. As these factors have been found to possibly improve the surgeons experience in the operating room and decrease the risk of sustaining injuries, we believe that increased focus should be directed to exploring the true effect of these recommendations, in addition to identifying other modifications that may be of benefit to the surgeon and the healthcare system in general in preventing the occurrence of such work-related MSK injuries.
Table 2 Percentage of surveyed hand surgeons with diagnosed disorders per region and number of respondents requiring treatment, requiring surgical treatment and requiring time-off work due to their musculoskeletal disorders

<table>
<thead>
<tr>
<th>Region</th>
<th>Percentage of respondents with injuries</th>
<th>Percentage of injured respondents requiring treatment</th>
<th>Percentage of treated respondents requiring surgical treatment</th>
<th>Percentage of treated respondents requiring time-off work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck</td>
<td>30.4</td>
<td>13.9</td>
<td>3.6</td>
<td>4.0</td>
</tr>
<tr>
<td>Shoulder</td>
<td>23.1</td>
<td>15.0</td>
<td>4.9</td>
<td>4.0</td>
</tr>
<tr>
<td>Elbow</td>
<td>26.0</td>
<td>13.3</td>
<td>2.1</td>
<td>1.5</td>
</tr>
<tr>
<td>Forearm, wrist and hand</td>
<td>52.0</td>
<td>27.3</td>
<td>10.0</td>
<td>6.6</td>
</tr>
<tr>
<td>Hip and thigh</td>
<td>6.5</td>
<td>3.8</td>
<td>1.4</td>
<td>1.2</td>
</tr>
<tr>
<td>Knee and lower leg</td>
<td>12.3</td>
<td>8.1</td>
<td>5.2</td>
<td>3.4</td>
</tr>
<tr>
<td>Foot and ankle</td>
<td>9.5</td>
<td>6.7</td>
<td>1.2</td>
<td>1.2</td>
</tr>
<tr>
<td>Lower back</td>
<td>34.5</td>
<td>19.4</td>
<td>4.2</td>
<td>5.7</td>
</tr>
</tbody>
</table>

Figure 2 Musculoskeletal disorders and complaints among survey participants.

We believe that our study has some limitations that are common with these types of prevalence studies. Recall bias is always a risk in surveys that depend on the respondents ability to recall events or factors that occurred in the past. In addition, while the majority of the surgeons identify their injuries as work-related, other factors that may have come into effect cannot be ruled out. Another weakness is that the survey used was not assessed for validity or reliability, especially the included self-reported measures. It is possible that some deficiency can be identified in such types of surveys, but a validation study would be required to explore these possible missed indicators and can be an area for future research.

CONCLUSION

Our current study has shown a high occurrence of work-related MSK injuries sustained by hand surgeons. Increased awareness and preventative measures are key to minimize the financial and psychological burden on these surgeons and the healthcare system. To our knowledge this study is the first of its kind to assess these types of injuries in this surgeon sub-specialty.

ARTICLE HIGHLIGHTS

Research background

Common tasks required by hand surgeons need both forceful and repetitive maneuvers, which can
subject these surgeons to the risk of musculoskeletal injuries during their years in practice.

**Research motivation**
These injuries can place a physical and psychological burden on the surgeon, which can in turn affect the healthcare system. Therefore, attention should be directed at studying their prevalence and associated factors.

**Research objectives**
The objective of the study was to assess the prevalence, characteristics and impact of musculoskeletal disorders among hand surgeons.

**Research methods**
A modified version of the physical discomfort survey was sent to surgeons who were members of the American Society for Surgery of the Hand via e-mail. The collected data were analyzed using descriptive statistics, one-way analysis of variance, and Fisher’s exact test. P values of < 0.05 were considered statistically significant.

**Research results**
Of the 578 respondents, 60.4% reported that they had sustained a work-related musculoskeletal injury, of which the most common diagnoses were lateral elbow epicondylitis, low back pain and carpal tunnel syndrome.

**Research conclusions**
We have shown a high prevalence of musculoskeletal disorders among hand surgeons, with more than half of the surveyed surgeons reporting a sustained injury.

**Research perspectives**
These results should increase awareness on this aspect and fuel future studies directed at preventing these types of work-related injuries, thus minimizing the financial and psychological burden on these surgeons and the healthcare system.

**FOOTNOTES**

**Author contributions:** Alqahtani SM and Alzahrani MM contributed to the concept, design, study execution, manuscript writing and review; Bicknell R and Pichora D contributed to the concept, design, manuscript writing and review.

**Institutional review board statement:** Not applicable as this was a survey.

**Informed consent statement:** Not applicable as this was a survey.

**Conflict-of-interest statement:** None conflict of interest pertaining to current study.

**Data sharing statement:** No additional data are available.

**STROBE statement:** The authors have read the STROBE Statement - checklist of items, and the manuscript was checked according to the STROBE Statement - checklist of items.

**Open-Access:** This article is an open-access article that was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution NonCommercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: https://creativecommons.org/Licenses/by-nc/4.0/

**Country/Territory of origin:** Canada

**ORCID number:** Saad M Alqahtani 0000-0002-9925-2480; Mohammad M Alzahrani 0000-0003-1299-1529; Ryan Bicknell 0000-0001-9321-980X; David Pichora 0000-0002-3234-118X.

**S-Editor:** Wang JL
**L-Editor:** A
**P-Editor:** Wang JL
REFERENCES


