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Left-Handedness Among Orthopaedic Surgeons and Trainees

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Background: The impact of left-handedness on orthopaedic surgeons and trainees has not been well described. We investigated the prevalence and perceived impact of left-handedness among orthopaedic surgeons and trainees.

Methods: We distributed a survey regarding handedness to active members of the American Orthopaedic Association and the Council of Orthopaedic Residency Directors affiliates, including department chairs, program directors, and residency and fellowship program coordinators. Program coordinators were asked to distribute the survey to their current residents and fellows.

Results: Of 510 survey respondents, 78 (15%) were identified as left hand dominant (LHD). Regarding scalpel/cautery use, 64% of LHD respondents reported using their left hand primarily and 10% reported using their right hand primarily; 26% of LHD respondents described themselves as ambidextrous in scalpel/cautery use, compared with 4.7% of right hand dominant (RHD) respondents ($p < 0.001$). Regarding suturing, 53% of LHD respondents reported using their left hand primarily and 38% reported using their right hand primarily; 9.0% of LHD respondents described themselves as ambidextrous when suturing, compared with 1.9% of RHD respondents ($p = 0.012$). Only 5.1% of LHD respondents reported having received laterality-specific psychomotor training, whereas 17% perceived a need for such training during residency; RHD respondents reported similar rates. Ambidexterity in scalpel/cautery use or suturing among LHD respondents was not associated with the perception that their left-handedness was advantageous. LHD attending surgeons were more likely than LHD trainees to perceive their handedness as advantageous ($p = 0.007$).

Conclusions: Fifteen percent of orthopaedic surgeons and trainees who responded to our survey were LHD. LHD respondents reported significantly higher rates of ambidexterity in both scalpel/cautery use and suturing compared with RHD respondents. Ambidexterity was not associated with a self-perception that left-handedness was advantageous. LHD-attending surgeons were significantly more likely than LHD residents/fellows to perceive their left-handedness as advantageous. There may be benefits to pairing LHD residents with LHD faculty surgeons early in their training to provide mentorship and insight regarding performing surgical procedures left handed.

Level of Evidence: Level IV.

Disclosure: The **Disclosure of Potential Conflicts of Interest** forms are provided with the online version of the article (<http://links.lww.com/JBJSOA/A168>).

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The estimated prevalence of right-handedness in the general population is 87% to 90%.^{1,2} Historically, left-handedness has been viewed as a negative prognosticator of surgical skill.³⁻⁶ However, left-handedness may provide advantages. Left hand-dominant (LHD) people have a higher rate of ambidexterity compared with right hand-dominant (RHD) people; this difference is attributed to the adjustments required to perform manual tasks in a “right-handed world”.⁷ In addition, LHD surgical residents performed better on psychomotor tests of tactile-spatial ability.^{4,8}

The impact of left-handedness on orthopaedic surgeons and trainees has not been well described. Studies of general surgery and neurosurgery report unique challenges inherent to training of and practice as LHD surgeons.^{5,6,9,10} LHD trainees may be required to adapt to surgical instruments and an operative environment that is designed for the RHD surgeon; conversely, a RHD attending surgeon may encounter difficulty when teaching a LHD trainee.^{9,11}

In addition, the laterality of the musculoskeletal system introduces a complicating aspect unique to orthopaedic surgery: surgeons may use each hand differently or adjust their body positions to accommodate their hand dominance, depending on the side of the body being operated on. A retrospective study of 1 RHD arthroplasty surgeon's performance found inferior outcomes in patients who underwent left-sided (compared with right-sided) primary total knee arthroplasty, indicating the potential importance of an orthopaedic surgeon's hand dominance as it relates to the laterality of the musculoskeletal system.¹²

Therefore, we sought to investigate the prevalence and perceived impact of left-handedness among orthopaedic surgeons and trainees.

Materials and Methods

After obtaining the institutional review board exemption, we developed a cross-sectional survey (see Appendix) by using a modified Delphi technique with a panel comprising the current and former residency program directors, a LHD department chair, and 2 LHD residents. This survey received approval of the American Orthopaedic Association (AOA) Survey Review Workgroup and was submitted via SurveyMonkey (www.surveymonkey.com) for electronic distribution to active members of the AOA and the Council of Orthopaedic Residency Directors affiliates, including department chairs, program directors, and residency and fellowship program coordinators. Program coordinators were asked to distribute the survey by email to their current residents and fellows.

We received 510 survey responses (Table I). Most respondents (409, 80%) were men. More than half of respondents (267, 52%) were attending surgeons, who represented all orthopaedic subspecialties. Hand dominance was defined for the purposes of this investigation as writing primarily with the designated hand. We found no significant differences in subspecialty distributions between LHD and RHD respondents. The remaining respondents were residents (195, 38%) or fellows (48, 9.4%). The largest proportion of attending respondents (235, 83%) were affiliated with academic institutions.

Statistical Analysis

Responses were entered into a spreadsheet for analysis (Excel 2016, Microsoft Corp). Descriptive and inferential statistical analyses were

TABLE I Characteristics of 510 Survey Respondents

Characteristic	N (%)
Sex	
Male	409 (80)
Female	99 (19)
Not answered	2 (0.4)
Training level	
Resident	195 (38)
Fellow	48 (9.4)
Attending surgeon	267 (52)
Subspecialty*	
Arthroplasty	54 (13)
Foot and ankle	29 (7.2)
Hand	60 (15)
Pediatrics	44 (11)
Shoulder and elbow	27 (6.7)
Sports medicine	59 (15)
Spine	33 (8.2)
Trauma	60 (15)
Tumor	25 (6.2)
General practice	13 (3.2)
Practice setting†	
Academic	235 (83)
Private	46 (16)
Military	3 (1.1)
Hand used for writing	
Primarily left	78 (15)
Primarily right	427 (84)
Ambidextrous	5 (1.0)

*Only fellows (n = 48) and attending surgeons (n = 267) answered this question. †Only attending surgeons (n = 267) answered this question.

performed using SPSS Statistics, version 26.0 (IBM Corp). Pearson χ^2 tests were used to analyze categorical variables, except when estimated cell counts were 5 or fewer, in which case Fisher exact tests were used. Statistical significance was defined as $\alpha = 0.05$.

Source of Funding

The authors did not receive any funding or grants in support of their research for or preparation of this work.

Results

Seventy-eight respondents (15%) were identified as LHD. Five respondents were identified as ambidextrous regarding handwriting and were excluded from the analysis. The remaining 427 respondents (84%) were identified as RHD.

Of the 78 LHD respondents, 46% reported that right-handed instruments were inherently more challenging to use. Only 1 LHD respondent reported having left-handed surgical instruments available for use. A total of 42% of LHD

TABLE II Self-Reported Practice Patterns of 505 Survey Respondents*

Hand Preference	N (%)	
	LHD Respondents (n = 78)	RHD Respondents (n = 427)
Scalpel/cautery use		
Primarily left	50 (64)	1 (0.23)
Primarily right	8 (10)	406 (95)
Ambidextrous	20 (26)	20 (4.7)
Suturing		
Primarily left	41 (53)	2 (0.47)
Primarily right	30 (38)	417 (98)
Ambidextrous	7 (9.0)	8 (1.9)

*LHD = left hand dominant and RHD = right hand dominant.

respondents had considered or attempted to change their handedness for surgery.

During scalpel/cautery use, 64% of LHD respondents reported using their left hand primarily and 10% reported using their right hand primarily (Table II). The remaining 26% of LHD respondents described themselves as ambidextrous regarding scalpel/cautery use, which was a significantly larger percentage than among RHD respondents (4.7%) ($p < 0.001$).

When suturing, 53% of LHD respondents reported using their left hand primarily and 38% reported using their right hand primarily. A significantly larger proportion of LHD respondents (9.0%) described themselves as ambidextrous regarding suturing, compared with RHD respondents (1.9%) ($p = 0.012$).

Of the 78 LHD respondents, only 35 (45%) reported using their left hand primarily for both scalpel/cautery use and suturing. This proportion accounts for 6.9% of the total study population. Seven LHD respondents (9.0%) reported using their right hand primarily for both scalpel/cautery use and suturing.

A significantly larger proportion of LHD respondents had encountered training difficulties because of handedness differences between themselves and the teaching surgeon (36%) compared with RHD respondents (6.1%) ($p < 0.001$; Table III). We found no significant difference in the proportions of male and female residents who reported having experienced training difficulties related to handedness. Fifteen percent each of LHD and RHD respondents encountered difficulty in teaching because of handedness differences between themselves and their trainees. Only 5.1% of LHD respondents had received laterality-specific psychomotor training, whereas 17% perceived a need for such training during surgical residency. Similar rates were reported by RHD respondents. The subgroup analysis showed that, overall, a significantly greater proportion of residents (28%) perceived a need for laterality-specific training compared with attendings (16%) ($p = 0.029$). However, we found no such differences between LHD and RHD residents or between LHD and RHD attendings.

Forty-five percent of LHD respondents perceived being left-handed as advantageous in a surgical field, 19% perceived it as disadvantageous, and 36% perceived it as neither advantageous nor disadvantageous (Table IV). LHD attending surgeons were more likely than LHD trainees to perceive their handedness as advantageous ($p = 0.007$). LHD respondents who reported ambidexterity with scalpel/cautery use and/or suturing were not more likely to perceive their handedness as advantageous. We found no significant differences in prevalence or self-perception of left-handedness across subspecialties.

TABLE III Self-Reported Implications of Handedness of 505 Survey Respondents*

Experience/Perception	N (%)	
	LHD Respondents (n = 78)	RHD Respondents (n = 427)
Had difficulty being trained (learning) because of a difference in handedness between yourself and the trainer		
Yes	28 (36)	26 (6.1)
No	50 (64)	401 (94)
Had difficulty training (teaching) because of a difference in handedness between yourself and the trainee		
Yes	12 (15)	64 (15)
No	66 (85)	363 (85)
Received laterality-specific training for psychomotor skills		
Yes	4 (5.1)	29 (6.8)
No	74 (95)	398 (93)
Perceive a need for formal laterality-specific training in surgical residency		
Yes	13 (17)	73 (17)
No	65 (83)	354 (83)

*LHD = left hand dominant and RHD = right hand dominant.

TABLE IV Self-Perception of Left- or Right-Handedness of 505 Survey Respondents *

How Do You Perceive Being (Left/Right)-Handed in a Surgical Field?	N (%)			
	LHD Respondents		RHD Respondents	
	Trainees (n = 33)	Attending Surgeons (n = 45)	Trainees (n = 209)	Attending Surgeons (n = 218)
Advantageous	9 (27)	26 (58)	116 (56)	100 (46)
Neutral	12 (36)	16 (36)	92 (44)	117 (54)
Disadvantageous	12 (36)	3 (6.7)	1 (0.48)	1 (0.46)

*LHD = left hand dominant and RHD = right hand dominant.

Discussion

The prevalence of left-handedness among orthopaedic surgeons and trainees who responded to our survey was 15%. This prevalence is slightly higher than that of the general population (10%–13%) and slightly lower than the neurosurgical population (17%)^{1,2,10}. LHD respondents reported significantly higher rates of ambidexterity in scalpel/cautery use and suturing compared with RHD respondents. However, ambidexterity among LHD surgeons was not associated with a perception of their handedness being advantageous. Interestingly, LHD attending surgeons were significantly more likely to perceive their handedness as advantageous compared with LHD residents/fellows.

These results may indicate evolving self-perception as left-handed surgeons progress through their training and career. Significantly more LHD respondents experienced difficulty in the learner role than did their RHD counterparts. This experience may represent a “desirable difficulty,” which is a challenge that may initially slow the rate of apparent learning while optimizing the long-term retention and transfer of acquired skills¹³. The benefit of such “desirable difficulty” during training may not be appreciated by surgeons until later in their careers, possibly accounting for the difference in self-perception between LHD trainees and attending surgeons.

Left-handed surgeons were more likely to suture right handed than to perform scalpel/cautery use right handed. This difference may be attributable to the ergonomic design of needle drivers optimized for a right-handed surgeon versus the relative versatility of the scalpel or cautery. Of note, less than half (45%) of LHD respondents reported operating with their left hand primarily. By contrast, nearly all RHD surgeons (94%) reported operating with their right hand primarily. In addition to the ergonomic designs of instruments and operating room set-up favoring right-handed use, this difference may reflect the fluidity of dexterity among left-handed people and the relatively rigid hand dominance of the right-handed population⁷. This finding echoes the experience of left-handed dental students, who were found to demonstrate “a very strong sense of adaptability” in a clinical setting that is oriented to right-handed practitioners¹⁴.

Reported use of left-handed surgical instruments was almost entirely absent among respondents. However, left-handed

surgical instruments, particularly needle drivers and scissors, may offer considerable benefit for left-handed surgeons, as has been discussed in the context of cardiothoracic surgery¹⁵. In addition, both left- and right-handed surgeons may benefit from ambidexterity training, the importance of which has drawn recent attention in both general surgical and neurosurgical studies^{16,17}. LHD and RHD respondents reported similar rates of receiving and perceiving a need for laterality-specific training during residency. Development of motor skills in the nondominant hand may be an overlooked component of surgical training that would benefit both left- and right-handed trainees¹⁸.

Our study has several limitations. First, our results may be subject to response bias. For example, left-handed recipients may have been more apt to respond. Moreover, hand preference and practice patterns were self-reported, rather than observed. Second, the distribution method of our survey precluded calculation of a response rate. Third, the largest proportion of respondents were affiliated with academic institutions, so our results may not be generalizable to all surgical settings or to all practicing orthopaedic surgeons. However, the respondents represented all orthopaedic subspecialties.

Although we found no significant differences in prevalence or self-perception of left-handedness across subspecialties, handedness may have different effects on surgeons depending on subspecialty. The laterality inherent to the musculoskeletal system has implications for a surgeon’s hand dominance, which have been described in a single-surgeon study¹². However, we did not explore this in our investigation. A larger study may provide results that are more generalizable to practicing orthopaedic surgeons as a whole and may permit further exploration of differences in the impact of handedness by subspecialty.

This study suggests that there are challenges for left-handed orthopaedic trainees and for right-handed surgeons training left-handed learners. A significantly higher percentage of LHD orthopaedic surgeons are ambidextrous compared with RHD surgeons. Future research may inform the development of techniques that facilitate surgical skill transfer to left-handed trainees. There may be benefit in intentionally pairing left-handed residents with left-handed faculty surgeons early in their training to provide mentorship and insight relating to operating left-handed. A crowd-sourced compilation of such left-handed

“pearls” may be gathered and made available for future generations of left-handed surgeons and those training them.

Appendix

 Supporting material provided by the authors is posted with the online version of this article as a data supplement at [jbjs.org \(http://links.lww.com/JBJSOA/A169\)](http://links.lww.com/JBJSOA/A169). ■

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