Original Article

A Survey of Surgeon Interest in Individually Sized Laparoscopic Instruments

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Abstract

Objectives: Allowing surgeons the option of individually sized laparoscopic instruments can potentially improve the ergonomics of laparoscopic surgery. We investigate interest in individually sized laparoscopic instruments among minimally invasive trained surgeons.

Materials and Methods: Cross-sectional survey of 166 surgeons performing laparoscopic surgery in the disciplines of obstetrics/gynecology, general surgery, and urology. Items investigated surgeon knowledge, attitudes, potential usefulness, and interest regarding dissemination and implementation of individually sized laparoscopic instruments.

Results: Overall mean knowledge of individually sized laparoscopic instruments ranged from strongly disagree to disagree and did not differ by glove size. Overall mean attitudes, dissemination, and implementation for individually sized laparoscopic instruments were between neutral and agree. Overall mean usefulness for individually sized laparoscopic instruments was neutral. There was a general pattern of small glove size having greater mean values than medium glove size for individually sized laparoscopic instruments for the topics of attitudes, usefulness, dissemination, and implementation.

Conclusion: We found that those with small glove sizes are interested in individually sized laparoscopic instruments. We recommend that as surgeon demographics continue to diversify, especially with a larger number of women typically with smaller glove sizes becoming surgeons, there is a potential benefit for individually sized laparoscopic instruments. Hospitals, surgical centers, and clinical practices should consider making such individually sized laparoscopic instruments available to surgeons. This can potentially address the ergonomic concerns of surgeons and also improve surgical practice.

Keywords: Ergonomics, laparoscopy, surgical gloves, surgical instruments

Introduction

In surgical specialty residency programs, women range from 86.4% in obstetrics and gynecology to 22% in general surgery.[1] Although women and men typically have different surgeon glove sizes, laparoscopic instruments are primarily a one-size-fits-all paradigm, in which instruments are designed for the average male surgeon glove size of 7.0–7.5.[2] This one-size-fits-all paradigm for laparoscopic instruments is of potential concern, as difficulty using a laparoscopic instrument can extend surgery time and possibly harm a patient.[3]

Laparoscopy for use in minimally invasive surgery is a major component of surgical practice.[4] Laparoscopic surgery has benefits over open surgery for gynecologic procedures such as hysterectomies where those performed laparoscopically have less blood loss and less postoperative recovery time in hospital than when performed abdominally.[5,6] As minimally invasive surgery is commonly used for a variety of surgical procedures, recommendations are available for optimal surgeon ergonomics to limit surgeon discomfort.[7] This includes optimal trocar placement, visual cues, and

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patient bed positioning based on surgeon height.[8] There are many trocar configuration approaches ranging from single port to five port that can be used for successful surgical outcomes.[9] However, surgeons still experience discomfort with their surgical instruments which prevents adherence to the recommended ergonomic posture when performing laparoscopy.[10]

As ergonomic recommendations do not fully address surgeon concerns when performing laparoscopy, the standardized glove size for laparoscopic surgical instrumentation places surgeons with smaller glove sizes at a disadvantage early in their training.[11] In addition, differences in training can impact clinical outcomes for many procedures.[12] Although simulation training can help trainees become more comfortable with laparoscopy,[13] this does not address the ergonomic concern of standardized glove size for laparoscopic surgical instrumentation. As women tend to have smaller glove sizes and smaller stature, they tend to experience more ergonomic concerns than men when performing laparoscopy.[14] Women performing laparoscopy had an increased level of muscle activation of the upper limb and higher fatigue as compared to men.[15] Furthermore, women performing laparoscopy with a surgical glove size of 5.5–6.5 had greater percentages of discomfort and pain in their shoulder area than men.[16]

There is a potential need for surgical practices to have available individually sized laparoscopic instruments. We are unaware of any studies about surgeon knowledge and attitudes regarding individually sized laparoscopic instruments. We investigate surgeon knowledge, attitudes, usefulness, dissemination, and intention to use individually sized laparoscopic instruments.

Materials and Methods

Setting

We administered a cross-sectional anonymous survey conducted over the Internet from February 2022 to September 2022. We contacted by e-mail various residency program coordinators, private practices, and local hospitals. We used a snowball design where we asked these recipients to forward the link to our online survey. Inclusion criteria were residents, fellows, and attendings who perform laparoscopic surgery in the disciplines of obstetrics and gynecology, general surgery, and urology. The study was conducted in accordance with the Declaration of Helsinki and was approved by Nassau Health Care Corporation Institutional Review Board with (approval number: IRB# 21-405; approval date: 12/30/2021). Informed consent was obtained from all participants.

Variables

Preferred surgical glove size categories were the standard glove size of 7.5 (medium), glove sizes <7.5 (small), and glove sizes >7.5 (large). Demographic questions were age (years), sex (male, female), and self-reported race/ethnicity (white, nonwhite). Surgical discipline included obstetrics and gynecology, general surgery, and urology. There were only two individuals from urology, and they were grouped with general surgery for data analysis. The level of training included physician assistant, resident physician, fellow, fellow in training program with a focus on laparoscopic surgery, attending, and attending who completed a fellowship with a focus on laparoscopic surgery. The level of training content was categorized as nonresident versus resident due to the small number of nonresident responses from the other categories. The three physician assistants were grouped with residents. Years of experience and the number of laparoscopy cases performed each month were also recorded. Survey questions were original items created for this survey and investigated surgeon knowledge, attitudes, potential usefulness, and interest regarding dissemination and implementation of individually sized laparoscopic instruments. A Likert style scale ranging from 1 = strongly disagree to 5 = strongly agree was used to measure the items. The questions and Cronbach–alpha reliability are shown in Table 1.

Statistical analysis

Mean and standard deviation were used to describe the continuous variables. Frequency and percentage were used to describe the categorical variables. Analysis of variance compared the continuous variables. The Pearson Chi-square test compared the categorical variables. The least significant difference *post hoc* analyses were conducted. Multivariate linear regression analyses were conducted for the scales that significantly differed in the univariate analyses. All *P* values were two tailed with an alpha level of $P < 0.05$. IBM SPSS Statistics version 28 was used for all analyses (IBM Corporation, Armonk, NY, 2021).

Results

There were 172 survey responses to the survey. Six participants who reported an average of zero laparoscopic surgery cases each month were excluded, as the survey was for those with experience regularly performing laparoscopic surgery. The 166 responses analyzed had glove-size groups of small (size <7.5, $n = 123$, 74.1%), medium (size 7.5, $n = 27$, 16.3%), and large (size >7.5, $n = 16$, 9.6%). There were two participants that already used individually sized laparoscopic instruments when performing surgery.

Table 2 shows several sample characteristics that significantly differed between the glove-size groups. The large glove-size group had the greatest mean age ($P < 0.001$) and years of

experience ($P < 0.001$). The small glove-size group had the greatest percentage of females ($P < 0.001$), obstetrics and gynecology discipline ($P = 0.002$), and resident training level ($P = 0.01$).

Table 3 shows information about the scales. Overall mean knowledge was between strongly disagree to disagree. Overall mean usefulness was neutral. Overall mean attitudes, dissemination, and implementation were between neutral and agree. Several comparisons of scales by glove size significantly differed in the overall analysis: attitudes that standard glove-size laparoscopic instruments were awkward to use ($P < 0.001$), the usefulness of individually sized laparoscopic instruments ($P < 0.001$), dissemination for obtaining individually sized laparoscopic instruments,

Table 1: Likert-style Scale questions regarding individually sized laparoscopic instruments

Topic	Question	Cronbach-alpha
Knowledge	1. I am aware that laparoscopic instruments are made for both smaller and larger glove sizes	0.7
	2. I am aware of a company where I can purchase individually sized laparoscopic instruments based on surgeon glove size	
Attitudes	1. I believe that laparoscopic instruments are often awkward to use	0.8
	2. I believe that the "one size fits all" approach of laparoscopic instruments negatively affects my surgical abilities	
Usefulness	1. An individually sized laparoscopic instrument would decrease my operative time	0.9
	2. An individually sized laparoscopic instrument would decrease the cost of surgery	
	3. An individually sized laparoscopic instrument would decrease surgery complication rates	
	4. An individually sized laparoscopic instrument would increase the number of surgeries I perform per month	
	5. An individually sized laparoscopic instrument would decrease my musculoskeletal pain associated with performing surgeries	
	6. An individually sized laparoscopic instrument would encourage me to attempt more complicated surgeries	
Dissemination	1. My practice should purchase individually sized laparoscopic instruments	0.8
	2. My practice should ask the laparoscopic surgeons if they want individually sized laparoscopic instruments	
Implementation	1. I want to seek additional information about individually sized laparoscopic instruments	0.9
	2. I intend to seek additional information about individually sized laparoscopic instruments	
	3. I plan to talk to my practice about purchasing individually sized laparoscopic instruments	

Table 2: Comparisons for glove size and sample characteristics

Variable	Size <7.5 small (*n*=123)	Size 7.5 medium (*n*=27)	Size >7.5 large (*n*=16)	*P*
Age (years), mean (SD)	33.2 (8.37)	41.2 (12.04)	46.9 (14.59)	<0.001
Sex (female), *n* (%)	103 (83.7)	4 (14.8)	0	<0.001
Race/ethnicity (nonwhite), *n* (%)	62 (50.4)	12 (44.4)	8 (50.0)	0.85
Discipline, *n* (%)				
General surgery	34 (27.6)	21 (77.8)	7 (43.8)	<0.001
Obstetrics and gynecology	89 (72.4)	6 (22.2)	9 (56.3)	
Training level (resident), *n* (%)	91 (74.0)	16 (59.3)	6 (37.5)	0.01
Experience (years), mean (SD)	5.6 (6.89)	11.9 (11.00)	15.8 (12.24)	<0.001
Laparoscopy cases (*n*), mean (SD)	11.9 (12.38)	16.6 (13.76)	12.6 (9.69)	0.21

Two people from urology were included in the general surgery discipline. Three physician assistants were included in the training level category of residents. SD: Standard deviation

Table 3: Comparisons for glove size and scales

Variable	Mean (SD)				*P*	*Post hoc*
	All (*n*=166)	Size <7.5 small (*n*=123)	Size 7.5 medium (*n*=27)	Size >7.5 large (*n*=16)		
Knowledge	3.4 (1.41)	3.3 (1.34)	3.8 (1.76)	3.4 (1.26)	0.30	-
Attitudes	6.9 (2.02)	7.3 (7.81)	5.6 (2.12)	5.8 (2.07)	<0.001	Small > medium (*P*<0.001)
						Small > large (*P*=0.003)
Usefulness	18.1 (4.82)	19.0 (4.30)	15.5 (5.60)	15.5 (4.99)	<0.001	Small > medium (*P*<0.001)
						Small > large (*P*=0.01)
Dissemination	7.3 (1.73)	7.6 (1.70)	6.5 (1.87)	7.0 (1.15)	0.01	Small > medium (*P*=0.004)
Implementation	10.0 (2.82)	10.3 (2.74)	8.9 (2.89)	9.4 (2.94)	0.03	Small > medium (*P*=0.01)

SD: Standard deviation

and implementation of individually sized laparoscopic instruments. The *post hoc* analyses showed that the small glove-size group had a significantly greater mean than the medium glove-size group for each of these scales and a significantly greater mean than the large glove-size group for attitudes and usefulness [*P* values in Table 3]. Knowledge about individually sized laparoscopic instruments did not significantly differ between the glove size groups.

Table 4 shows the multivariate linear regression analyses. For attitudes, females were significantly ($P = 0.002$) associated with increased attitudes that standard glove-size laparoscopic instruments were awkward to use. Glove size was not significantly associated with increased attitudes. For usefulness, small glove size was significantly associated with increased usefulness of individually sized laparoscopic instruments ($P = 0.01$). Dissemination and implementation had nonsignificant *P* values for the overall analysis of variance in the regression analyses which precluded conducting and interpreting multivariate regression analysis output.

Discussion

We found that overall mean knowledge of individually sized laparoscopic instruments ranged from strongly disagree to disagree and did not differ by glove size. Overall mean attitudes, dissemination, and implementation for the use of individually sized laparoscopic instruments were between neutral and agree. Overall mean usefulness for individually sized laparoscopic instruments was neutral. There was a general pattern of small glove size having greater mean values than medium glove size for individually sized laparoscopic instruments for the topics of attitudes, usefulness, dissemination, and implementation.

Table 4: Multivariate linear regression analysis for attitudes and usefulness

Variable	Attitudes *B* (SE)	*P*	Usefulness *B* (SE)	*P*
Size				
Medium	Reference		Reference	
Small	0.87 (0.50)	0.08	3.22 (1.26)	0.01
Large	0.58 (0.60)	0.34	0.19 (1.52)	0.90
Age (years)	0.02 (0.03)	0.47	0.02 (0.08)	0.85
Sex (female)	1.36 (0.44)	0.002	0.23 (1.12)	0.84
Discipline				
General surgery	Reference		Reference	
Obstetrics and gynecology	−0.20 (0.35)	0.57	−0.02 (0.90)	0.99
Training level (resident)	0.70 (0.47)	0.14	0.97 (1.21)	0.42
Experience (years)	−0.02 (0.04)	0.68	−0.01 (0.10)	0.90
Constant	4.28 (1.18)	<0.001	14.41 (3.01)	<0.001

Variance inflation factor values indicated no multicollinearity concerns. *B*: Unstandardized beta, SE: Standard error, Adjusted R^2: Attitudes: 0.18, Usefulness: 0.07

We found that overall awareness of knowledge regarding individually sized laparoscopic instruments was low. Previous research reports low knowledge and access among surgeons regarding laparoscopic surgery in low- and middle-income countries.[17] Our finding for knowledge regarding individually sized laparoscopic instruments is similar to this pattern. We suggest that providing information about individually sized laparoscopic instruments would allow surgeons to be more informed and knowledgeable so that they can make the best-informed decisions for their surgical practice.

We found that mean attitudes regarding the use of individually sized laparoscopic instruments were greater for small glove sizes than other glove sizes, and in the multivariate analysis instead of glove size differences, we found that females had greater attitudes than males. A review found mixed findings for gender differences in performing laparoscopic surgery where some studies reported males had better skills than females, whereas other studies reported no difference.[18] Our findings for attitudes suggest that females may have had challenges in performing laparoscopic surgery and believe that individually sized laparoscopic instruments could offer some benefits for improving their laparoscopic surgery performance.

We found that the usefulness regarding individually sized laparoscopic instruments was greater for small glove sizes than medium glove size. Previous research reports that surgeons with small glove sizes who use standardized laparoscopic instruments have greater grip strength decline and increased musculoskeletal strain.[10] Our findings are consistent with this pattern. We suggest that this occurs because those with small glove sizes believe in the usefulness of individually sized laparoscopic instruments.

We found that those with small glove sizes agreed that dissemination and implementation regarding individually sized laparoscopic instruments was necessary. User-centered design is key for the successful implementation of innovations.[19] As those with small glove sizes agree with the need for dissemination and implementation of individually sized laparoscopic instruments, such a dissemination and implementation approach has the potential for success. We recommend that hospitals, surgical centers, and clinical practices disseminate information to surgeons about the availability of individually sized laparoscopic instruments and also provide surgeons the option to use individually sized laparoscopic instruments.

A strength of this study is the overall pattern showing that those with smaller glove sizes are interested in individually sized laparoscopic instruments. This study has several limitations. First, we had a relatively small sample size. Second, two-thirds of our sample were from resident

physicians and the results may be indicative of lower levels of surgeon experience and skills. Future research should study interest in individually sized laparoscopic instruments among more experienced physicians.

Conclusion

We found that those with small glove sizes are interested in individually sized laparoscopic instruments. We recommend that as surgeon demographics continue to diversify, especially with a larger number of women typically with smaller glove sizes becoming surgeons, there is a potential benefit for the use of individually sized laparoscopic instruments. Hospitals, surgical centers, and clinical practices should consider making such individually sized laparoscopic instruments available to surgeons. This can potentially address ergonomic concerns of surgeons, facilitate optimal patient care, and improve surgical practice.

Author contributions

Christine Aboseif: study design, data acquisition, data interpretation, manuscript drafting, final approval of manuscript; Austin McEvoy: study design, data acquisition, data interpretation, reviewed manuscript critically for important intellectual content, final approval of manuscript; Joshua Fogel: study design, data analysis, data interpretation, reviewed manuscript critically for important intellectual content, final approval of manuscript; Mary Fatehi: data interpretation, reviewed manuscript critically for important intellectual content, final approval of manuscript; Madison Gambrill: data interpretation, manuscript drafting, final approval of manuscript; Godwin Onyeike: data interpretation, reviewed manuscript critically for important intellectual content, final approval of manuscript. All authors have read and agreed to the final version of the manuscript.

Data availability statement

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Conflicts of interest

There are no conflicts of interest.

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