

Perspectives on Laparoscopic Surgery Among Chinese General Surgery Residents: Single-Site Survey Study with Instructive Lessons for Program Directors and Teaching Hospitals

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Abstract

Background To assess resident perspectives on laparoscopic surgery and how it might differ compared to open surgery. Materials and Methods Anonymous surveys were sent to residents who came to hepatic surgery service rotation during Sep 2013 to Aug 2017. Statistical comparisons were conducted using student T-test, comparing mean satisfaction and preferences. Results A total of 80 residents responded to the survey, distributed across the spectrum of training levels. Of the 80 respondents, 9 were in their first year of training, while 18, 41, and 12 were in their second, third, or fourth years of training, respectively. Among them, there were 11 residents who were not included in the final analysis. Residents indicated that they preferred open procedures for conferring greater exposure to operating (7.172 ± 1.4646 for open vs 4.414 ± 2.1442 for laparoscopy, $p < 0.001$). Residents indicated that laparoscopic procedures were preferred in aiding in understanding of the surgical procedure (6.814 ± 1.3323 for open vs 7.407 ± 1.3014 for laparoscopy, $p = 0.016$). Conclusions These results suggest that residents prefer open procedures for hands-on experience, while laparoscopic procedures confer the advantage of facilitating the learning of a surgical procedure. This provides an opportunity for intervention, as minimally invasive surgeries(MIS) are a major component of modern surgical practice and, therefore, must be an area of strength in the training of surgical residents.

Background

Modern surgical residency programs are increasingly placing a strong emphasis on minimally invasive procedures. This is prudent, given demonstrated improvement in outcomes with laparoscopic and other minimally invasive approaches for certain surgically treated pathologies [1–3]. The volumes of these minimally invasive procedures at some centers has presented a challenge to adequate exposure to these procedures, and studies based on surveys of residents indicates some concern regarding adequate exposure. This was observed in a Dutch study, in which many residents expressed desire to be skilled with advanced laparoscopic procedures, but < 20% believed they would be proficient at the end of their training program [4]. Simulation has been proposed as a solution to the challenge of inadequate clinical volume and experience, and has been implemented in many centers. Simulation has facilitated enhanced exposure to the minimally invasive approach, and has been associated with improved training outcomes when studied [5–8]. Additionally, other electronic training to improve resident exposure to and skill with minimally invasive surgical techniques has been proposed [9]. The true innovators in this regard have been in gynecology and urology [10, 11].

While these studies have confirmed the importance of minimally invasive surgery and training in this field, comparatively little research has assessed resident perceptions comparing minimally invasive and open approaches, and no studies exist assessing these questions in residents in Chinese hospitals. One study did confirm some exposure to laparoscopic procedures when urology residents and program directors from the United States and Canada were surveyed, but only 38% of respondents were satisfied with their training [12]. This is the case even in a field where laparoscopy was introduced and taken up with vigor. There is an absence of more recent data, though, and an interesting observation has been

made that in the U.S., residents lack confidence in some open procedures due to higher volumes of laparoscopic cases [13]. The data is therefore somewhat conflicted, though this could be a function of time and increases in the number of trained laparoscopic surgeons. The aforementioned Dutch study is the only study to assess general surgery resident perceptions related to minimally invasive surgery, specifically, and would serve as a good basis for comparison. No such data exists for residents in China. The current study focuses on assessing perceptions of the residents who finished their rotations in the hepatic surgery service regarding the strengths and limitations of their exposure to and training in minimally invasive surgery. This study allows conclusions to be drawn regarding resident assessments and suggests possible interventions that might improve resident education quality while ensuring adequate exposure to minimally invasive procedures such that residents feel sufficiently prepared for their future careers.

Methods

Hospital, Residency Structure, and Resident Selection

This study was conducted at PUMCH, a general teaching hospital affiliated with Peking Union Medical College(PUMC). The general surgery resident program usually consists 30–40 residents who have obligatory rotation requirements through serval subspecialties for a period of 2–3 month each. Residents were surveyed after the completion of their obligatory rotation on the hepatic surgery service. The yearly surgery volume in hepatic surgery session is around 400, in which 100–150 are minimal invasive.

Survey Administration

Surveys were administered to residents via the class officer of each year of class. Participation in the study was voluntary. Residents were surveyed on basic demographic information including gender and training year, as well as more detailed questions related to exposure to and subjective experience with minimally invasive procedures. Residents were also asked to directly compare laparoscopic and open approaches with respect to various parameters, and ranked the two approaches on a numerical scale from 1–10, with 1 representing not helpful at all and 10 signifying extremely helpful. The Institutional review board(IRB) exemption was obtained from PUMCH; the survey is conducted anonymously to protect the identity of the respondent.

Statistical Analysis

Statistical comparisons were conducted using student T-test, comparing mean satisfaction and preferences. These comparisons were conducted after dividing residents on the basis of experience (Postgraduate Year (PGY)-1 and PGY-2 vs PGY-3 and PGY-4) and resident exposure to minimally invasive surgery (< 25% of MIS cases vs > 25%).

Results

Survey Response Rate and Respondent Characteristics

Overall, a total of 80 residents responded to the survey, distributed across the spectrum of training levels. Of the respondents, 9 were in their first year of training, while 18, 41, and 12 were in their second, third, or fourth years of training, respectively. 60 of the respondents (75%) were male, while the remaining 20 respondents were female. See *Table 1* for basic demographic data regarding year in training and gender. Among them, there were 11 residents across various years of training who participated in fewer than 10 surgical procedures during the hepatic surgery service. Given this limited experience, their responses were not included in the final analysis.

Exposure to and Roles within Minimally Invasive Surgical Procedures

Overall, survey respondents reported relatively minor exposure to laparoscopic procedures, with more than half (56.52%) identifying fewer than 25% of the cases they were involved in as being minimally invasive in nature, see *Table 1*. When asked about their predominant role in laparoscopic procedures, residents indicated they were often carrying the laparoscope or guiding the camera (> 95%) and, much more rarely, playing a role as first assistant. No resident indicated that he/she had served as the primary surgeon, or operator, in a laparoscopic procedure. In contrast, residents more frequently noted roles with greater responsibility in open procedures, namely as first assistant (24.64%) or even as the primary operator (5.80%).

Perceptions and Limitations of Laparoscopic Surgery Exposure and Education

Residents were also asked to reflect both on the limitations of laparoscopic procedures, in general, as opposed to open approaches, but also on the shortcomings of their own training in minimally invasive techniques. Two of the most frequently cited limitations to minimally invasive procedures relative to their open counterparts were lack of adequate tactile feedback (76.06% of respondents) and difficulty with achieving hemostasis (57.75% of respondents). Residents were distributed across multiple responses, which can be seen in *Figure 1A*.

Residents were also asked to assess limitations of open surgical approaches, and most frequently identified inadequate visualization of anatomical structures (64.79% of respondents) and fatigue during procedures (50.70% of respondents) as potential difficulties. More limitations are identified in *Figure 1B*.

When assessing the limitations of their own training in laparoscopic procedures, residents identified inadequate clinical volume for exposure (92.96% of respondents) and lack of access to appropriate

simulation equipment (70.42% of respondents) as difficulties. Resident-identified inadequacies in their own curriculum are further explored in *Figure 1C*.

Comparisons of Laparoscopic and Open Surgical Approaches

Residents were invited to indicate their satisfaction with various aspects of their surgical training and to draw distinctions between laparoscopic and open cases. Residents indicated that they preferred open procedures for conferring greater exposure to operating (7.172 ± 1.4646 for open vs 4.414 ± 2.1442 for laparoscopy, $p < 0.001$), more helpful in learning to use surgical instruments (7.351 ± 1.2746 for open vs 5.691 ± 1.4256 for laparoscopy, $p < 0.001$), and increased opportunities for participation in the surgical process (6.982 ± 1.3023 for open vs 6.407 ± 1.7530 for laparoscopy, $p = 0.048$). Interestingly, residents indicated that laparoscopic procedures were preferred in aiding in understanding of the surgical procedure (6.814 ± 1.3323 for open vs 7.407 ± 1.3014 for laparoscopy, $p = 0.016$). For a summary of resident perspectives son these and other comparisons, see *Table 2*.

Data were also divided based on the levels of resident training year (PGY–1 and 2 vs PGY–3 and 4) and levels of experience with laparoscopy, see *Table 3*. It was observed that more inexperienced residents, during the first two years of training, preferred minimally invasive surgery for learning anatomy over open procedures (7.923 ± 1.2558 vs 6.769 ± 1.3009). This was a statistically significant difference ($p = 0.03$), while a statistically significant difference was not observed for more senior residents. However, interestingly, when the data were divided based on the experience with laparoscopy disregarding of the year of training, residents who have participated in more laparoscopic procedures are the ones preferred minimally invasive surgery for learning anatomy (7.905 ± 1.6705 vs 6.919 ± 1.9615 , $p = 0.028$). Irrespective of level of experience or exposure to laparoscopy, residents indicated they preferred open surgery with respect to their level of intraoperative training, as well as to the learning of the surgical instruments. Interestingly, the junior residents (PGY–1 and 2) regarded laparoscopy procedure being more helpful in understanding the surgical procedure than the open surgery (8.000 ± 1.2910 vs 6.692 ± 1.6525 , $p = 0.034$), while the senior residents (PGY–3 and 4) had virtually no preference. On the other hand, senior residents prefer open procedures to minimally invasive surgeries for the opportunities in participation (6.936 ± 1.2922 vs 6.170 ± 2.0143 , $p = 0.031$); whereas the junior residents didn't have preference.

Discussion

In the modern era, minimally invasive approaches to surgery have become increasingly preferred over open approaches when possible, and the residency-training infrastructure have attempted to keep pace with innovation in this area. To this end, it seems prudent to solicit resident perspectives, in other words to allow stakeholders to be involved in the process of curricular innovation and development. There is a paucity of literature assessing resident perceptions of their training in minimally invasive procedures, and the tendency in most studies is to focus on objective measures of training quality [14, 15]. While these

studies have strengths, and have highlighted clearly the limitations of training in laparoscopic surgery, there is value in identifying potential areas of improvement from the perspective of the trainees.

This group of residents identified limited exposure to minimally invasive surgery, with almost 60% of respondents indicating that fewer than 25% of the surgeries in which they participated used a laparoscopic approach. This finding corresponds with the perception of 92.96% of respondents that their case volume for minimally invasive surgical procedures was inadequate. Without sufficient exposure to actual clinical cases, and with > 70% of respondents lamenting the absence of simulation equipment, it should be unsurprising that residents indicate that open procedures are quite preferable in terms of affording opportunities for operative training. Of note, residents during their first two years noted that laparoscopic procedures were significantly better than open procedures for visualizing and learning anatomy. This could be attributed to the level of participation noted by the residents. More senior residents are more likely to be directly participating in open procedures, as opposed to being more restricted to retraction and lesser participation. As such, a less experienced resident might express preference for observing a procedure on a 2D screen, which confers the opportunity to actually visualize anatomy. Irrespective of level of experience or exposure to laparoscopy, residents indicated they preferred open surgery with respect to the level of intraoperative participation. This is unsurprising, given that even interns (PGY-1 residents) have the opportunity in the OR to occasionally perform initial incisions, suture, drain abscesses, and perform other intraoperative tasks.

The opinions of these residents, while of potentially limited generalizability given that the data were generated from a single teaching site, provide insight into how one might intervene to improve laparoscopic surgical training programs, thereby ensuring that residents feel more comfortable moving forward with appropriate and adequate laparoscopic surgical acumen. The literature strongly supports the value of simulation training in enhancing operative skill, and the respondents also identify this as an important area for improvement. Another important observation is that many residents reported feeling less involved in laparoscopic procedures than with an open approach, and this corresponds to the roles that the residents indicated they were filling in the two kinds of procedures. While maintaining adequate visualization with a skilled resident manipulating the laparoscope is critical to the success of minimally invasive surgeries, residents must also feel competent at performing an operation. Of note, residents indicated that they understood individual operations better with the laparoscopic approach. One could hypothesize that having the opportunity to simply observe procedures while operating the camera might lead to this improved understanding, but a balance must be struck such that residents can gain experience with all roles required during minimally invasive surgery. Attending concerns about resident competence, which might prevent enhanced resident involvement in a procedure, might be assuaged, for example, with enhanced simulation-based training. Of note, concerns over clinical volume and operative role have been observed in other studies of laparoscopic surgical training, indicating that the perspectives of the respondents in this study are not significantly different from residents in other countries [4]. Given that these observations are not new, but have been observed previously, it is incumbent upon those working in curriculum development and residency program administration to endeavor to improve access, both to clinical cases and adequate operative role, as well as simulation equipment to compensate when

these former dimensions are lacking. In so doing, these stakeholders, in concert with the resident they train, can ensure appropriate training, improved resident confidence, and improved outcomes.

Conclusion

We can conclude that residents prefer open procedures for hands-on experience, while laparoscopic procedures confer the advantage of facilitating the learning of a surgical procedure. This provides an opportunity for intervention, as minimally invasive surgeries(MIS) are a major component of modern surgical practice and, therefore, must be an area of strength in the training of surgical residents.

Abbreviations

MIS: minimally invasive surgeries; PUMC: Peking Union Medical College; IRB: Institutional review board; PGY: Postgraduate Year.

Declarations

Ethics approval and consent to participate: We obtained verbal consent from all participants because this study was an anonymous survey that participants will not be exposed to any harm or information disclosure. This procedure was approved by the ethics committee of Peking Union Medical College Hospital.

Consent for Publication: Not applicable.

Availability of data and material: The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Competing interests: Authors state that no conflicts of interests exist.

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Authors' contributions: TY C and SD D designed the study. B J, ZB Z, YC Z and HF X collected the data. B J and ZB Z were involved in data cleaning and verification. TY C and SD D analyzed the data. B J drafted the manuscript. YL M and XT S revised the manuscript. B J, TY C and SD D contributed to the interpretation of the results and critical revision of the manuscript for important intellectual content and approved the final version of the manuscript. All authors have read and approved the final manuscript.

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Tables

Table 1: Demographic of the respondents

Characteristic	Total (percent)	With more than 10 surgery experience
Male	60 (75%)	53 (76.81%)
Female	20 (25%)	16 (23.19%)
Year of experience		
1	9 (11.25%)	7 (10.14%)
2	18 (22.50%)	15 (21.74%)
3	41 (51.25%)	35 (50.73%)
4	12 (15.00%)	12 (17.39%)
Number of surgery performed		
<10	11 (13.75%)	
10-20	35 (43.75%)	35 (50.72%)
21-30	14 (17.50%)	14 (20.29%)
31-40	10 (12.50%)	10 (14.49%)
>40	10 (12.50%)	10 (14.49%)
Experience with laparoscopic surgery		
<25%	49 (61.25%)	39 (56.52%)
25-50%	24 (30.00%)	23 (37.68%)
50-75%	5 (6.25%)	5 (5.52%)
>75%	2 (2.5%)	2 (2.90%)

Your role in surgery	Open	Laparoscopy
Operator	4 (5.80%)	0 (0.00%)
First assistant	17 (24.64%)	3 (4.35%)
Second assistant/scope guider	48 (69.57%)	66 (95.65%)

Table 2: Perception of residents comparing laparoscopic and open procedure

	<i>laparoscopy</i>	<i>open</i>	<i>P value</i>
Helpfulness in learning abdominal anatomy	7.610 ± 1.4858	7.140 ± 1.4071	0.083
Providing opportunity in surgical training	4.414 ± 2.1442	7.172 ± 1.4646	<0.001
Helpfulness in learning to use surgical instruments	5.691 ± 1.4256	7.351 ± 1.2746	<0.001
Helpfulness in understanding the disease pathology	6.807 ± 1.4447	7.070 ± 1.2516	0.301
Helpfulness in understanding the surgical procedure	7.407 ± 1.3014	6.814 ± 1.3323	0.016
Participation in the whole surgical process	6.407 ± 1.7530	6.982 ± 1.3023	0.048
Promoting active learning	6.879 ± 1.7278	7.339 ± 1.3596	0.112

Table 3: Perceptions of residents analyzed by experience level

3-1 Helpfulness in learning abdominal anatomy

	Laparoscopy	Open	P value
<25%	7.359 ± 1.4598	7.077 ± 1.5625	0.413
>25%	7.905 ± 1.6705	6.919 ± 1.9615	0.028

3-2 Opportunity in operational training

	Laparoscopy	Open	P value
<25%	4.216 ± 2.0294	7.243 ± 1.5167	0
>25%	4.789 ± 2.1751	7.048 ± 1.3956	0.001

3-3 Helpfulness in learning to use operating apparatus

	Laparoscopy	Open	P value
<25%	5.526 ± 1.7043	7.342 ± 1.3412	0
>25%	5.778 ± 1.1144	7.048 ± 1.4992	0.005

3-4 Helpfulness in understanding the disease pathology

	Laparoscopy	Open	P value
<25%	6.784±1.2939	7.158±1.3462	0.224
>25%	6.850±1.7252	7.050±1.2344	0.676

3-5 Helpfulness in understanding the surgical procedure

	Laparoscopy	Open	P value
<25%	7.395±1.1280	6.949±1.5209	0.149
>25%	7.429±1.5991	6.714±1.1019	0.1

3-6 Participation in whole surgical process

	Laparoscopy	Open	P value
<25%	6.784±1.2278	7.243±1.2112	0.11
>25%	6.188±1.3769	6.667±1.5275	0.331

3-7 Promoting active learning

	Laparoscopy	Open	P value
<25%	7.286±1.0167	7.595±1.2793	0.262
>25%	6.524±2.2720	7.048±1.2836	0.365

Figures

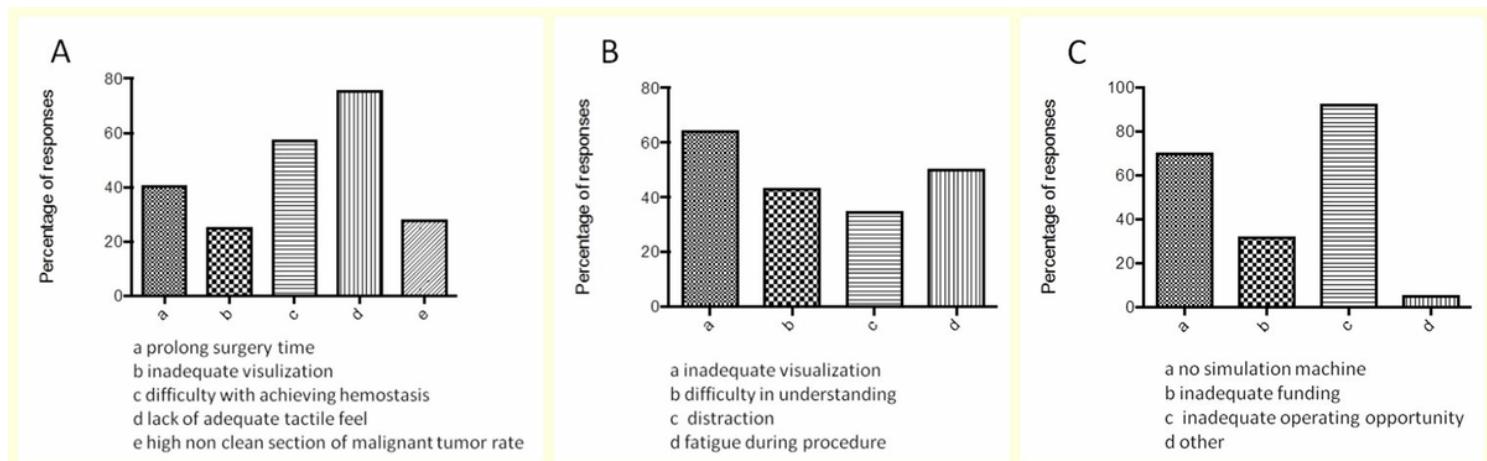


Figure 1

Responses of residents to questions: A) The shortcomings of laparoscopic procedure comparing to open surgery; B) Problems with open surgery; C) Problems with laparoscopy training.