



Impact of the COVID-19 pandemic on the training of general surgery residents

Surgical training and the COVID-19 pandemic

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Summary

Background The educational process of young doctors should be a topic of high interest, since it is central to preparing the new generations of healthcare providers. The COVID-19 pandemic has affected the medical system on multiple levels, including medical education.

Methods We conducted a descriptive survey study, designed to reflect the impact of the pandemic on the training of general surgery residents. Two questionnaires were delivered to general surgery residents at two different periods: one in the pre-COVID-19 era (December 2019) and one in the COVID-19 era (December 2020). Data were gathered on participants' characteristics, current clinical practice and knowledge, extracurricular activities, and involvement in the management of COVID-19 cases.

Results We registered 33 responses in the pre-COVID-19 era and 45 responses in the COVID-19 era. Most participants felt that the pandemic significantly affected their training in classic and laparoscopic surgery. The number of days per week that the residents were active in the operating room and the

possibility of training in laparoscopic surgery outside the hospital decreased significantly in the COVID-19 era. Most participants consider they have not gained sufficient knowledge to practice laparoscopic surgery or to assure their employment in another hospital after finishing their residency program.

Conclusion The pandemic reduced the hands-on activities of general surgery residents, while training in laparoscopy was deficient both before and during the pandemic. New training methods should be sought and used in order to adapt the educational system to the current context.

Keywords Minimally invasive surgery training · Coronavirus · Laparoscopy training · Surgical residency · Medical education

Main novel aspects

- The article provides an objective comparison of surgical training during pre-COVID-19 and COVID-19 periods.
- The article highlights the problems that have to be solved in order to assure appropriate training on minimally invasive surgery for general surgery residents.

Introduction

The COVID-19 (Coronavirus 19) pandemic has significantly affected the entire healthcare system and surgical practice in particular has been greatly affected, with a considerable reduction of the number of non-urgent interventions [1, 2]. The most negative effects have been felt maybe by doctors in training, with their education process being marked by the current pandemic conditions.

The training of residents should be treated as an important topic of discussion, since it prepares doc-

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tors for their future career, by defining their first steps and principles in their respective field. Even more so, in the current conditions, while the entire medical system is restructured to adapt to the pandemic conditions, the focus should also be directed into restructuring the educational program.

Evaluating the impact of the COVID-19 pandemic on the surgical training program is important in order to identify the main problems as well as to adapt the program and find efficient solutions in combating the effects of the current pandemic. The present study was a survey study regarding the changes brought about in the training program of general surgery residents by the current pandemic.

Methods

Our study was a single-center descriptive survey study. A survey was conducted in the pre-COVID-19 era (2019) and another survey was conducted in COVID-19 era (2020). The study protocol has been registered at [clinicaltrials.gov](https://www.clinicaltrials.gov), with the identifier NCT05069116 (link: <https://www.clinicaltrials.gov/ct2/show/NCT05069116?term=NCT05069116&draw=2&rank=1>). The study received the ethical approval of the Ethics Committee of Iuliu Hatieganu University of Medicine and Pharmacy of Cluj-Napoca (no 310/13.09.2021).

Study participants

The study took place within the Surgical Department at Iuliu Hatieganu University of Medicine and Pharmacy of Cluj-Napoca, including general surgery residents from six different hospitals.

The inclusion criteria were:

- General surgery residents
- Above second year of residency
- Residency program in Cluj-Napoca Medical Centre

The exclusion criteria were:

- Incomplete responses to the questionnaire
- Refusal to be included in the study

Survey timeline

The first survey was conducted in December 2019, aimed at assessing the training process of general surgery residents, with a focus on laparoscopic surgery.

The second survey was conducted in December 2020, with the purpose of assessing the training program of general surgery residents and the impact of the COVID-19 pandemic on the educational process.

Questionnaire

We developed two different questionnaires, focusing on the implications of laparoscopic surgery training.

The first questionnaire, for the initial part of the study, comprised three parts:

- Demographic data (sex, year of study, workplace)
- Current knowledge and current clinical practice habits (information regarding their theoretical preparation, as well as their involvement in the operating room)
- Extracurricular activities (opportunities and interest in such activities)

The second questionnaire, comprised four parts:

- Demographic data (sex, year of study, workplace)
- Current knowledge and current clinical practice habits (information regarding their theoretical preparation, as well as their involvement in the operating room)
- The management of COVID-19 cases (evaluating their implication in the different stages of the management of COVID-19 positive cases)
- Extracurricular activities in the pandemic context (opportunities and interest in such activities)

Data gathering and statistical analysis

The survey was conducted using a Google form questionnaire and data were gathered in an electronic database. We analyzed the subjective interpretation of each participant's view of the pandemic effects. On the other hand, we carried out an objective evaluation of the impact of the pandemic by comparing the responses to questions in the two study periods. Data analysis was performed using the statistical software program R version 3.5.1 (R Foundation, www.r-project.org). Categorical variables are represented as absolute value (percentage). Contingency tables were analyzed using Fisher's test. Normality of the distribution was determined using the Shapiro–Wilk test, by assessing the asymmetry and kurtosis of the distribution and by histogram visualization. Non-normally distributed data are represented as median (1st quartile, 3rd quartile). Differences between two non-normally distributed groups were assessed using the Mann–Whitney–Wilcoxon rank sum test. A *p* value under 0.05 was considered statistically significant.

Results

Study population

In the pre-COVID-19 era, we registered 33 responses to our survey. In the COVID-19 era, we had 45 respondents. The general characteristics of the participants are presented in Table 1.

Impact of the pandemic on the educational process

Participants were asked for their views on how the pandemic context influenced their educational process. Most participants felt that the pandemic sig-

Table 1 Demographics of study population

Variable		Overall (n= 78)	COVID-19 (n= 45)	Pre-COVID-19 (n= 33)	<i>p</i>
Gender	Female	17 (21.8%)	10 (22.2%)	7 (21.2%)	1
	Male	61 (78.2%)	35 (77.8%)	26 (78.8%)	
Age (years)	–	30 (29, 31)	30 (27, 30)	30 (29, 31)	<i>0.026</i>
Hospital	Chr1	9 (13.2%)	3 (8.6%)	6 (18.2%)	0.14
	Chr2	1 (1.5%)	0 (0%)	1 (3.0%)	
	Chr4	4 (5.9%)	1 (2.9%)	3 (9.1%)	
	Chr5	8 (11.8%)	4 (11.4%)	4 (12.1%)	
	IOCN	16 (23.5%)	8 (22.9%)	8 (24.2%)	
	IRGH	28 (41.2%)	17 (48.6%)	11 (33.3%)	
	Military	2 (2.9%)	2 (5.7%)	0 (0%)	
Year of residency	–	4 (4, 6)	4 (3, 6)	5 (4, 6)	<i>0.013</i>

italics show the statistically significant *p* values

Chr1 1st Surgery Clinic, *Chr2* 2nd Surgery Clinic, *Chr4* 4th Surgery Clinic, *Chr5* 5th Surgery Clinic, *IOCN* Oncology Institute Prof. Dr. Ion Chiricuța, *IRGH* Regional Institute of Gastroenterology and Hepatology Prof. Dr. O. Fodor, *Military* Military Hospital

Table 2 Impact of the pandemic on surgical training

Variable		Overall (n= 78)	COVID-19 (n= 45)	Pre-COVID-19 (n= 33)	<i>p</i>
Considered to have good laparoscopic surgery education	Yes	23 (29.5%)	13 (28.9%)	10 (30.3%)	1
	No	55 (70.5%)	32 (71.1%)	23 (69.7%)	
Days/week in the operating room	–	3 (3, 5)	3 (2, 4)	5 (3, 5)	<i><0.0001</i>
Active participation (hours/day)	–	4 (3, 5)	4 (3, 5)	4 (3, 5)	0.18
Theoretical preparation (hours/week)	–	5 (3, 8)	6 (3, 8)	5 (3, 6)	0.129
Considered they would be able to perform laparoscopic surgery in a surgical center after residency	Yes	28 (35.9%)	17 (37.8%)	11 (33.3%)	0.812
	No	50 (64.1%)	28 (62.2%)	22 (66.7%)	
Preparation in laparoscopy outside work hours	Yes	34 (43.6%)	10 (22.2%)	24 (72.7%)	<i><0.0001</i>
	No	44 (56.4%)	35 (77.8%)	9 (27.3%)	

The italicized values show the parameters with statistical significance

nificantly affected their training in classic surgery (77.8%, 35 participants) as well as in laparoscopic surgery (71.1%, 32 participants). Overall, 29 responders (64.4%) believe that the duration of the residency should be adapted because of the pandemic context.

Out of the 45 participants, 41 (91.1%) considered that the extracurricular opportunities for training decreased. Also, 35 participants (77.8%) believed their educational process might benefit from having more extracurricular opportunities.

Surgical training: the impact of the pandemic context

The daily active participation time in the operating room was a median of 4 h both in the pre-COVID-19 and COVID-19 era. The number of days per week that the residents were active in the operating room differed significantly between the pre-COVID-19 and COVID-19 period ($p < 0.0001$): median of 5 days/week versus 3 days/week, respectively.

The time that the residents dedicated weekly for their theoretical training did not differ significantly in the pre-COVID-19 era versus the COVID-19 era ($p = 0.129$): median of 5 h versus 6 h.

Regarding laparoscopic surgery, in the pre-COVID-19 era 69.7% of participants (23 out of 33) considered that they had not gained sufficient knowledge to practice laparoscopic surgery. In the COVID-19 era, 71.1% had the same opinion (32 out of 45 participants); there was no statistically significant difference between the two periods ($p = 1$).

The participants were asked whether they considered the training that they received in laparoscopic surgery sufficient to assure their employment in another hospital after finishing their residency program: 62.2% (28) responded “no” in the pre-COVID-19 era, and 66.7% (22) responded “no” in the COVID-19 era. No statistically significant difference was registered ($p = 0.812$).

The possibility of training in laparoscopic surgery outside the hospital was significantly different in the pre-COVID-19 era versus the COVID-19 era ($p < 0.0001$). Only 27.3% ($n = 9$) said that they did not have any possibility for such training in the pre-COVID-19 era, while 77.8% ($n = 35$) gave the same response in COVID-19 era.

A summary of the findings is provided in Table 2.

Involvement of surgical residents in the management of COVID-19-positive cases

Only 53.3% of residents ($n=24$) were involved in the diagnostic process of COVID-19 positive cases, while 68.9% ($n=31$) were involved in surgical treatment and 66.7% ($n=30$) were included in the postoperative follow-up of the patient.

Interest in extracurricular training programs in the pandemic context

The interest in extracurricular training programs was evaluated through several questions. Most participants believed they might benefit from more extracurricular activities: 77.8% ($n=35$). Regarding the types of activities preferred, hands-on workshops were the most popular choice (60%, 27 participants). Developing a plan for extracurricular activities, molded to each year of residency, was considered a good idea by 97.8% of participants ($n=44$). The idea of creating a training center dedicated to surgical residents was perceived as helpful by 86.75% of participants ($n=39$).

Discussion

There have been increasing concerns regarding the disadvantages and limitations of the current educational process for general surgery residents; this is reflected in several articles [3–6] published in the medical literature that try to identify the current problems and offer solutions. We believe that this subject is worth exploring, and raised awareness of in this topic might be the way to successfully meet the needs of residents in training. Furthermore, the COVID-19 pandemic added another obstacle in the training process: the persistence of this situation requires the restructuring of the educational system according to the current conditions. The trainee's perspective is also an important parameter to consider when trying to improve a training system—the present study intended to incorporate this characteristic and we therefore concentrated on the residents' views and opinions.

Study population

We observed that the interest of completing such a survey increased in the COVID-19 pandemic times, having 45 versus 33 participants in the pre-COVID-19 era. This may reflect that the interest and concern of residents regarding their educational process has increased in pandemic times. While our study was based on a single university center, it encompassed residents from seven different hospitals, assuring diversity among participants and their workplace environment.

Practical and theoretical training

Every training process should include a theoretical, individual preparation and a practical, hands-on part. Regarding the theoretical learning, interindividual variability is normal [7]; we assessed the number of hours that a participant allocates for this activity weekly. While there was no significant difference between the two periods, more hours were dedicated to studying in the COVID-19 era, when the practical training possibilities had decreased. Regarding the practical training, while the number of hours per operating day remained the same between the two periods (a median of 4 h), the number of days per week in which the residents were active in the operating room significantly decreased in the COVID-19 era (from 5 days per week to 3 days per week). While this might not be the ideal way to quantify the practical training of each general surgery resident, we believe that this accurately reflects their involvement in the intraoperative stage of the management of surgical patients.

Laparoscopic surgery training

As mentioned in the study design, the questionnaires focused on the educational process of minimally invasive surgery. In both periods, the majority of residents considered that their laparoscopy training was insufficient and that they had not gathered sufficient skills to assure their employment as a surgeon after residency. These affirmations should raise an alarm about the present educational process of general surgery residents. Laparoscopic surgery is known to have a prolonged learning curve, with reduced training opportunities for young surgeons [8, 9]. This is reflected in the results of our study, which underlines the fact that general surgery residents do not receive adequate laparoscopic training.

Impact of the pandemic on the educational process

The COVID-19 pandemic was declared in March 2020 and it radically changed the organization of the entire healthcare system: from the use of personal protective equipment for healthcare workers, maintaining physical distances and cleaning and disinfecting precautions to appropriate planning of hospital visits and admissions of patients and prioritizing certain cases [10–12]. Medical education has been severely disrupted as well [13–15]. Since the pandemic is ongoing, there should be close consideration of the educational impact and new training methods that can be implemented.

Some trends in surgical training did not change between the two study periods: for example, laparoscopic training seemed to be insufficient in the pre-COVID-19 period as well. However, most of the participants reported that the pandemic affected their train-

ing in both classic and laparoscopic surgery. At the same time, we observed a significant impact in the active participation in the operating room and the possibility of extracurricular training (such as workshops and conferences). Beside the training in general surgery [16], other surgical specialties were affected as well [17–19]. Hands-on training in the operating room has decreased due to the current conditions [16]. Moreover, hands-on extracurricular activities were also reduced, with the impact on the practical education of residents being even greater. In-hospital conditions might be difficult to adapt in order to accommodate a training program, but the utility of hands-on workshops and even virtual training methods [20, 21] should be explored more in these times so as to offer doctors in training new educational options. Interestingly, the majority of the respondents to the COVID-19 era questionnaire believed that the impact of the pandemic on their educational process was so important that the duration of their residency should be adapted accordingly. This conclusion needs to raise an alarm that changes in the training programs should be made promptly.

Extracurricular activities

The residents showed an increased interest in extracurricular activities in the current pandemic context, with hands-on workshops being the most requested type of activity. During the pandemic, due to social distancing and the fear of spreading the virus, conferences and workshops were postponed or moved online [19].

Management of COVID-19 cases

Although traditional medical education has been disrupted, the surgical residents who have completed the questionnaire reported a significant involvement in the management of COVID-19 positive patients: From the preoperative diagnosis to surgery and postoperative follow-up, the majority of residents were directly involved in these cases. Therefore, general surgery residents should be trained on how to properly manage these cases as well [22–24].

Advantages of the present study

The most important advantage of this study is its comparative nature, having the possibility to draw objective conclusions by comparing responses to two different surveys: one in the pre-COVID-19 era and one in the COVID-19 era. Another advantage of our study is the fact that it reflects the trainee's perspective of the educational system.

Limitations

The limitations of the present study are related to the study population, which was conditioned by voluntary participation and completion of the proposed survey. Also, some questions are based on the participants' opinion, resulting in a subjective evaluation. It is also important to note that the pre-COVID-19 era questionnaire was concentrated on evaluating only the training in laparoscopic surgery.

Conclusion

The COVID-19 pandemic has disrupted the usual activity of healthcare systems and educational systems, with young doctors in training being one of the most affected categories. The practical training of surgical residents has been affected by their reduced active participation in the operating room and the fewer possibilities for extracurricular training. Laparoscopic surgery training remains insufficient, being considered insufficient even before pandemic times. The educational system should focus on the preparation of young surgeons in minimally invasive surgical techniques.

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Conflict of interest C. Popa, D. Schlanger, F. Zaharie and N. Al Hajjar declare that they have no competing interests.

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