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Impact of COVID-19 pandemic on anesthesia resident's training program in Cairo University Hospital

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ABSTRACT

Background: The purpose of this study was to evaluate the impact of COVID-19 pandemic on the training process of anesthesia residents in Cairo University Hospital regarding technical skills, operative, and critical care experience.

Methods: This cross-sectional survey study included two groups of anesthesia residents according to the time of their residency in relation to the pandemic (before-pandemic group [$N = 44$] and during-pandemic group [$N = 42$]). The participants were asked to fill out a questionnaire regarding their training. The questionnaire included technical skills experience (regional anesthesia, vascular access, and advanced airway techniques, soft tissue ultrasound), operative and critical care experience, and duration of intensive care unit (ICU) rotation. The quality of training was graded as adequate, moderate, or deficient training according to the number of performed procedure/managed cases. Comparisons of continuous data were done using the Mann–Whitney test, and qualitative categorical was analyzed using the chi-square test.

Results: All the participants completed the questionnaire. The training in the during-pandemic group was lesser than that in the before-pandemic group for most of the technical skills except for soft tissue ultrasound which was more in the during-pandemic group. The operative experience was less in the during-pandemic group than that in the before-pandemic group. On the other hand, the ICU experience was more in the during-pandemic group than that in the before-pandemic group.

Conclusion: The COVID-19 pandemic disrupted the training program of anesthesiology residents with regard to elective procedures and produced over-training in critical care subspeciality

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1. Introduction

Since the beginning of Coronavirus disease-19 (COVID-19) pandemic, critical care management for patients with COVID-19 was prioritized, affecting other healthcare services with elective surgery among the most-affected services. The marked reduction in the number of surgical procedures during the pandemic could impact anesthesia residents training program [1]. Furthermore, this effect was augmented by the increased need for critical care services resulting in a continuous shift of anesthesia personnel from the operating theaters to critical care units [2,3].

In addition, the viral mutation resulted in multiple surges, and it is not clear whether the vaccination would eliminate the problem in the near future or not [4]. Having an adequate training is essential for anesthesia residents, being a critical specialty dealing with vital signs. Furthermore, it is essential to reach a balance between the pandemic-related healthcare service and the desired training for the anesthesia resident. Therefore, the impact of COVID-19 pandemic on the anesthesia resident training program should be evaluated first to identify points of defect and strength; correct the present gaps in training; and plan future programs adapted to the current new normal.

The aim of this study is to evaluate the impact of COVID-19 pandemic on the training process of anesthesia residents in Cairo University Hospital regarding technical skills, operative, and critical care experience.

2. Methods

This cross-sectional study was conducted in Cairo University Hospital after institutional ethics committee approval (MS-531-2021) from April to October 2022.

Two groups of anesthesia residents (of either sex) were included in the study. (1) Before-pandemic group: the latest two classes of residents who completed their residency before the pandemic (classes 2013 and 2014). (2) during-pandemic group: residents who spent the main part of their residency (for at least 2 years) in the pandemic (classes 2016 and 2017).

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Researchers distributed paper questionnaires to the intended group of anesthetists in the operating theatres. The participation was voluntary. Respondents returned the anonymously filled-out questionnaires to a locked box in the Anesthesia and Critical Care Medicine Department's secretary office. The study objectives were clearly explained at the beginning of the survey by contacting the participants via respective class's WhatsApp group.

3. The questionnaire

Before developing the questionnaire, we collected the opinion of expert anesthetists from different hospitals (personal communication) to specify the minimum number of supervised successful procedures needed to achieve adequate training regarding necessary skills for anesthesia residents during their training periods. The participants were asked to answer the questionnaire based on the program's logbook data. The clinical aspect of training was divided into technical skills, operative, and intensive care experience. The adequacy of clinical training was judged according to the number of procedure performed/cases managed by the resident under the supervision of a senior anesthetist and were categorized into adequate, moderate, or deficient training. The number of procedures/cases needed to fall in each category was gauged according to the importance and prevalence of such procedure/case. The questionnaire included technical skills (regional technique, soft tissue ultrasonography, vascular access technique, advanced airway techniques), operative (major abdominal, pediatric, obstetric and gynecological, head and neck, and neurosurgeries, and orthopedic surgeries), and intensive care experiences.

The questionnaire also included section regarding the knowledge acquired (academic and scientific progress of the residents according to an educational program certified by the educational committee of the Anesthesia Department Cairo University Hospital). The response to this section was either yes or no and the complete questionnaire is provided in Figure 1.

4. Statistical analysis

We collected data from a convenience sample including almost all the residents in each class.

The data were analyzed using the statistical package for the Social Sciences (SPSS) version 26 (IBM Corp., Armonk, NY, USA). Continuous data were checked for normality using the Shapiro–Wilk test, normally distributed data were expressed as mean ± standard deviations, and skewed data were expressed as median (quartiles). Comparisons of continuous data were done using the Student's t-test or Mann–Whitney test as appropriate. Qualitative categorical data were expressed as percentage and were analyzed using the chi-square test or exact test as appropriate. *P*-values less than 0.05 were considered statistically significant.

5. Results

Eighty-six anesthetists fulfilling the inclusion criteria completed the questionnaire for this study. The respondents were 44 for the before-pandemic group and 42 anesthetists for the during-pandemic group.

The median (quartiles) ages of the included anesthetists were 32 (32, 33) years and 28 (28, 29) year and in the before-pandemic group and during-pandemic group, respectively. The distribution of sex was comparable between the two groups (male sex represented 24/44 (55%) in the before-pandemic group and 21/42 (50%) in the during-pandemic group, *P*-value = 0.829. The total ICU rotation and the COVID-19 ICU (ICU dedicated for the management of critically ill COVID-19 patients) rotation duration was longer in the during-pandemic group than in the before-pandemic group, *P*-values < 0.001). (Table 1)

Regarding the technical skills such as regional anesthesia, vascular access, and advanced airway techniques, the training in the during-pandemic group was lesser than that in the before-pandemic group, while soft tissue ultrasound training was more in the during-pandemic group than that in the before-pandemic group (Figure 2).

Operating experience, including general surgery, neurosurgery, pediatric, obstetric, head and neck, and orthopedic surgeries, was less in the during-pandemic group than that in the before-pandemic group (Figures 3 and 4). On the other hand, the ICU experience was more in the during-pandemic group than that in the before-pandemic group (Figure 5).

All the interviewed anesthetists reported receiving comparable adequate training through lectures or virtual webinars on topics such as preoperative assessment, difficult airway guidelines, managing sepsis guidelines, managing ARDS guidelines, modes of mechanical ventilation, fluids and hemodynamic managements, advanced life support, and trauma management. However, lecture training regarding obstetric emergency and prematurity was lacking in the during-pandemic group (0 [0%] for both) in comparison to that in the before-pandemic group (44 [100%] for both), *P*-values < 0.001.

6. Discussion

We evaluated the level of resident training during COVID-19 pandemic in comparison to previous classes of residents and found that the training program was impaired during the pandemic. The standard number of performances of general skills as well as the experience in different specialties was not met in most of the

Age		Sex		Class	
Duration of ICU rotation		Duration of COVID unites			
Technical skills experience					
Regional Techniques	**Number of cases**				
Subarachnoid block	<100	100-200	>200		
Lumbar epidural catheter insertion	<10	10-15	>15		
Thoracic epidural catheter insertion	0	1-3	>3		
Caudal block	<6	6-10	>10		
Ultrasound guided supraclavicular brachial plexus block	0	1-2	>2		
Ultrasound guided transversus abdominis plane block	0	1-2	>2		
Soft tissue ultrasonography	**Number of cases**				
Transthoracic Echocardiography	0	1-5	>5		
Lung ultrasound	0	1-5	>5		
Vascular access techniques	**Number of cases**				
Radial artery cannulation	<20	20-25	>25		
Femoral artery cannulation	0	1-5	>5		
Internal jagular vein cannulation	<15	15-20	>20		
Subclavian vein cannulation	<10	10-15	>15		
Advanced airway techniques	**Number of cases**				
Fiberoptic intubation	0	1-2	>2		
Double lumen tube insertion	0	1-2	>2		
Operative experience					
Major abdominal surgery	**Number of cases**				
Whipple surgery	0	1-3	>3		
Major vascular surgery	0	1-3	>3		
splenectomy	0	1-7	>7		
colectomy	<5	5-10	>10		
Pediatric surgeries	**Number of cases**				
Tracheoesophageal fistula repair	<3	3-6	>7		
Congenital diaphragmatic hernia repair	0	1-2	>2		
Inguinal hernia	<5	6-10	>10		
Talipes repair	<11	11-20	>20		
Obstetric and gynecological surgeries	**Number of cases**				
Cesarean delivery for preeclampsia patient	<5	5-10	>10		
Cesarean delivery for eclampsia patient	0	1-2	>2		
Abdominal hysterectomy	<6	6-10	>10		
Postpartum Hemorrhage	0	1-3	>3		
Head and neck surgeries	**Number of cases**				
Laryngectomy	<4	4-6	>6		
Thyroidectomy	<6	6-10	>10		
Direct laryngoscopy	<6	6-10	>10		
Neurosurgeries	**Number of cases**				
Craniotomy	<20	20-30	>30		
Spine surgeries	<11	11-20	>20		
Orthopedic surgeries	**Number of cases**				
Hip surgeries	<6	6-10	>10		
Knee surgeries	<6	6-10	>10		
Shoulder surgeries	0	1-3	>3		
ICU experience	**Number of cases**				
Patients with septic shock	<10	10-25	>25		
Patients with ARDS	<20	20-40	>40		
Patients with Burn	<10	10-20	>20		
Patients with Trauma	<20	20-40	>40		
Regarding Knowledge of recent updates (through lectures or virtual webinars)	**Yes**		**No**		
Preoperative assessment of patients.					
Guidelines of difficult airway and airway management					
Guidelines of septic shock					
Guidelines of ARDS					
Modes of ventilation					
Fluid management and hemodynamics					
Advanced life support					
Management of trauma patient					
Anesthetic management of obstetrics with medical diseases					
Anesthetic concerns for pediatrics and prematurity					

Figure 1. The questionnaire. ARDS: acute respiratory distress syndrome.

Table 1. ICU rotation.

	Before pandemic (n = 44)	During pandemic (n = 42)	P-value
ICU rotation duration (months)	7 (7, 8)	10 (10, 12)	<0.001
COVID-19 ICU rotation (months)	0 (0, 0)	8 (8, 10)	<0.001

Data presented as median (quartiles). COVID: Coronavirus disease-19, ICU: intensive care unit.

residents who passed their residency timeline during the pandemic. On the other hand, the experience in critical care topics was higher in the same group of residents compared to their seniors, by the end of the training program of both groups.

There had been a marked reduction in the elective operations which dropped in some periods to a near standstill while the number of working intensive care beds increased resulting in increased trainee time in critical care at the expense of other anesthesia specialties [5,6]. Many residents were assigned to triaging zones, emergency departments, and medical units and this wasted more time from their training schedules. Physical distancing instructions resulted in limited room occupancy and disruption of education programs, lectures, and simulation classes [7]. Many

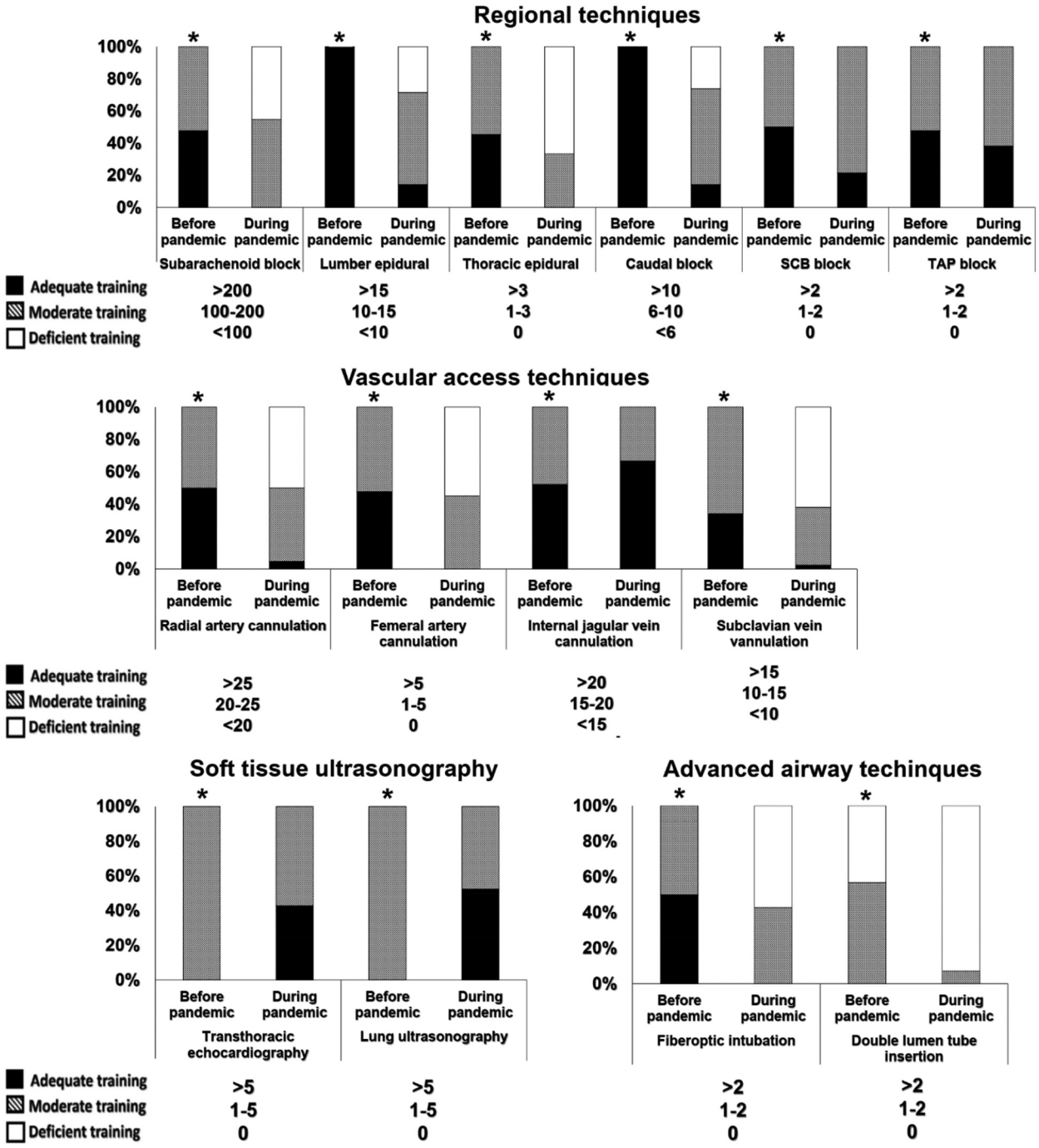

Figure 2. Technical skills experience, SCB: supraclavicular brachial plexus, TAP: transversus abdominis plane. * denotes significance between the groups.

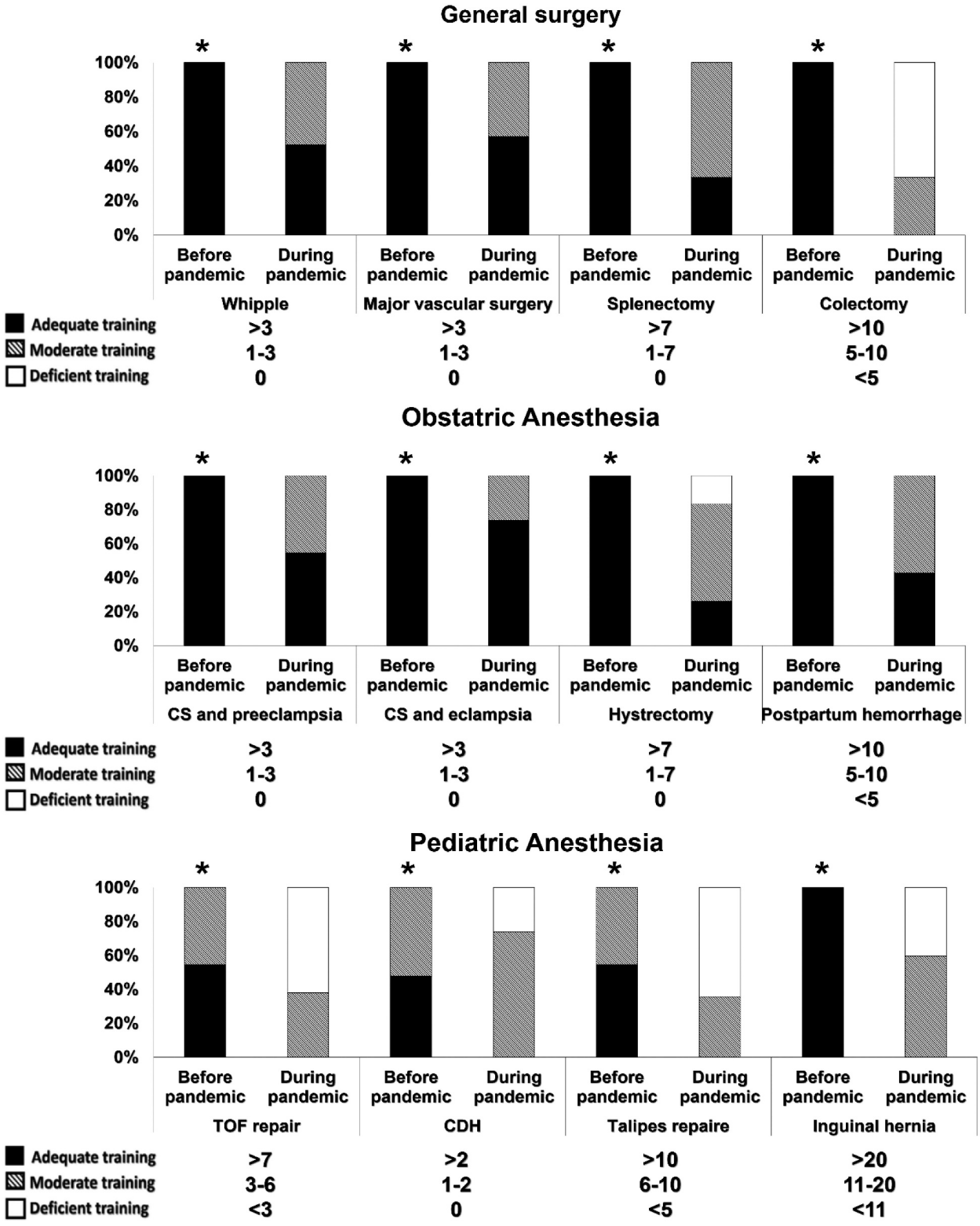

Figure 3. Operative experience for major abdominal, obstetric, and pediatric surgeries. CS: cesarean section, CDH: congenital diaphragmatic hernia, TOF: tracheoesophageal fistula. * denotes significance between the groups.

activities shifted with time to blended learning and e-learning methods; however, these methods do not compensate actual training in a craft specialty which requires essential hands-on skills [7,8]. Most of the residents developed COVID-19 infection and were quarantined for various durations, and this represented an additional disruption to training schedules. Most of anesthesia-related skills are classified as aerosol-generating procedures which require many precautions and protective equipment [9]; this represents another barrier which impaired the regular teaching; furthermore, it is recommended that airway management be performed by the most experienced physician [10], and this resulted in lower chance for young physician to acquire adequate chance for training.

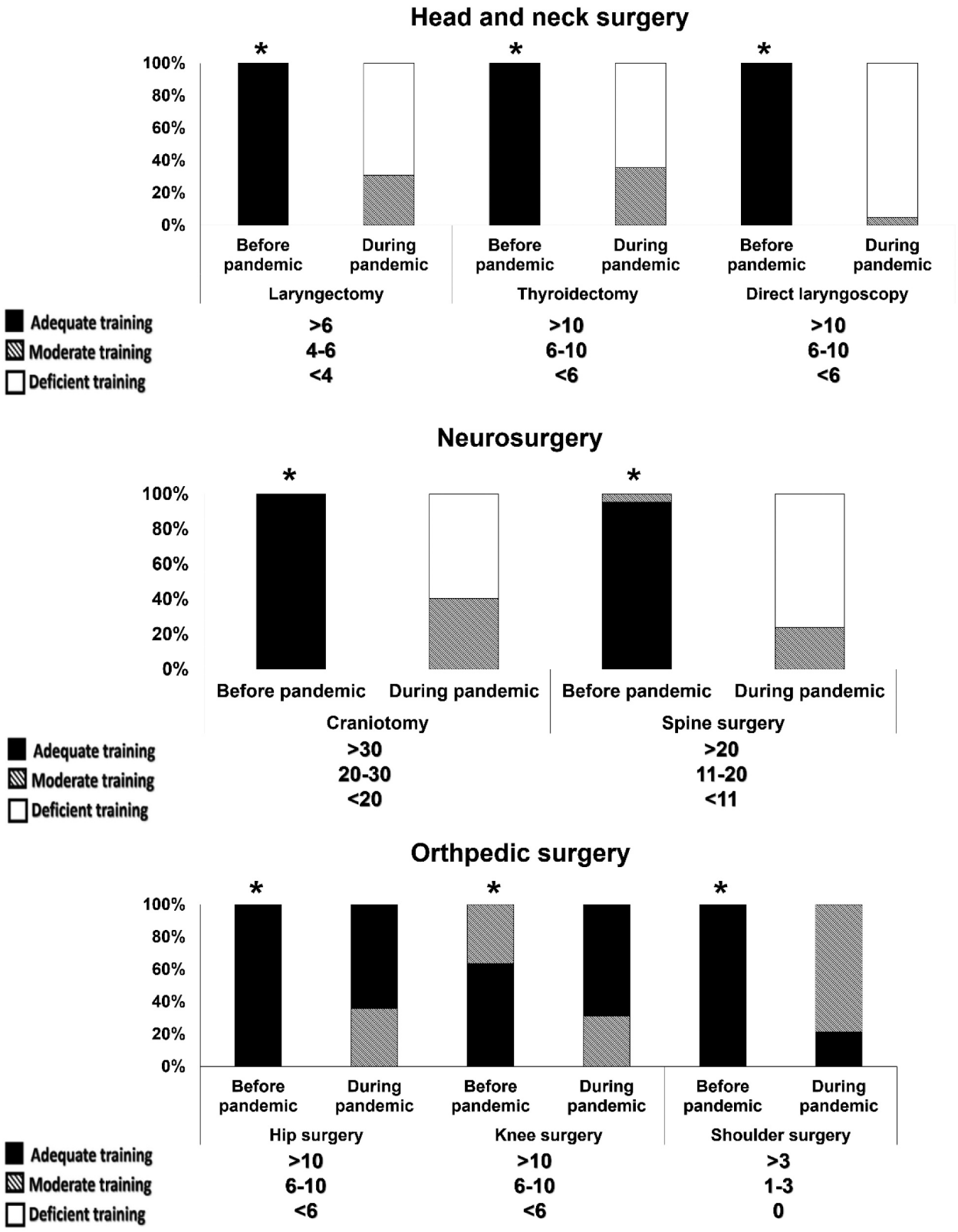

Figure 4. Operative experience for head and neck, orthopedic, and neuro-surgeries. * denotes significance between the groups.

Few reports had suggested the impact of COVID-19 pandemic on training of residents in different medical specialties [6–8]. However, our study represents the first actual evaluation of the outcome of the training curriculum with comparison of the current residents with previous classes of residents. Anesthesia is a specialty which is oriented with vital organ monitoring and support; therefore, defective training of residents represents a serious problem which requires long- and short-term planning. A major change in the world of medical education had been established after the pandemic; however, more attention should be provided towards blended learning, flipped classrooms, and

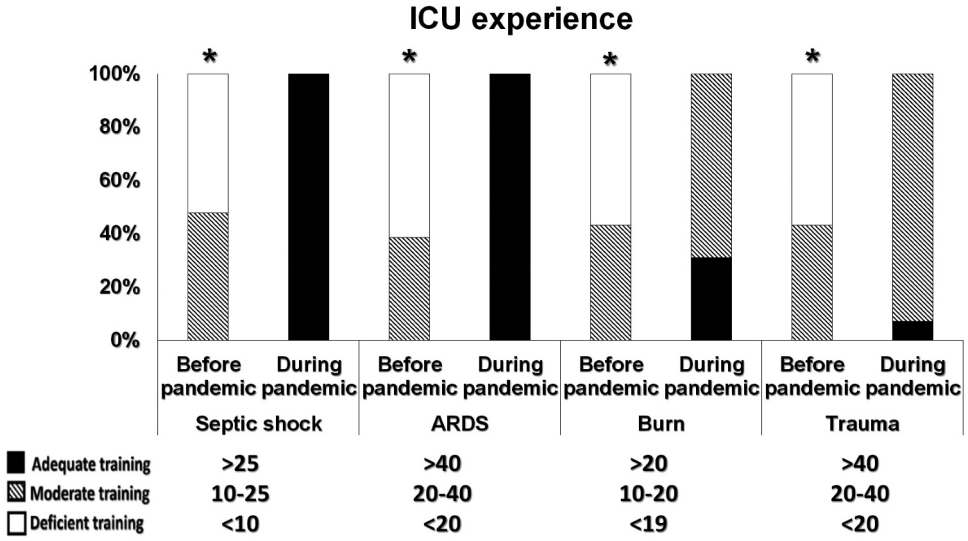

Figure 5. Intensive care unit experience. * denotes significance between the groups. ARDS: acute respiratory distress syndrome.

simulation to compensate for the disrupted curricula of medical training.

Our study had some limitations. The sample was a convenient sample; however, we are limited to the number of residents in each class, and we included almost all the targeted residents. The assessment was not entirely objective as it was provided by the participants; however, the provided information was based on data from the logbook. Finally, we did not collect the specific duration of the operative rotations.

In conclusion, the COVID-19 pandemic disrupted the training program of anesthesiology residents with regard to elective procedures and produced overtraining in critical care subspeciality.

7. Declarations

Ethical approval and consent to participate: ethical approval from Cairo University Hospital's Research Ethics Committee was obtained (MS-531-2021). Written informed consents were obtained from participants before inclusion.

Abbreviation

ARDS	acute respiratory distress syndrome
COVID-19	Coronavirus disease-19
ICU	intensive care unit
SPSS	Statistical Package for Social Science

Author contributions

AH: this author helped in study design, acquisition of data, and revising the manuscript.

FE: this author helped in study design, acquisition of data, and drafting the manuscript.

AH: this author helped in conception of the idea, study design, analysis of the data, and drafting and revising the manuscript.

MM: this author helped in study design, analysis of the data, and drafting and revising the manuscript.

DM: this author helped in conception of the idea, study design, and revising the manuscript.

SE: this author helped in study design, supervised the work, and revising the manuscript.

AH: this author helped in study design, supervised the work, and revising the manuscript.

All authors approved the manuscript and agreed to be accountable for all aspects of the work.

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Availability of data and material

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

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