RESEARCH ARTICLE

Laparoscopic Surgery Practice in the Era of COVID-19: The Pakistani Perspective

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Abstract

Aims: The SARS-CoV-2 coronavirus disease-19 (COVID-19) pandemic has wreaked havoc worldwide. Not only has it severely impacted the way of life, but also damaged global economies and worsened social disparities, including those in healthcare. The pandemic, having imposed an enormous burden on global healthcare infrastructure, has led to drastic changes in medical and surgical practices, including those of laparoscopic and minimally invasive surgery. This study aimed to explore the practice of laparoscopic surgeons during the COVID-19 era in Pakistan.

Materials and methods: Surgeons involved in laparoscopic surgery (LS) were approached via e-mail practicing in different surgical setups and cities of Pakistan. After taking Institutional Review Board (IRB) approval and informed consent a questionnaire was filled out by all participating laparoscopic surgeons. The data was then analyzed in SPSS version 26.

Results: A total of 168 surgeons involved in LS from different disciplines responded to the invitation and filled out the online questionnaire. The mean age of the surgeons was 48.72 ± 8.04 years and most of them were married and the majority belonged to the major cities of the country, i.e., Karachi, Lahore, Multan, Islamabad, and Rawalpindi. Surgeons who participated had a mean practice experience of 12.12 ± 6.88 years (minimum 3 and maximum 31 years). Most of the respondents were General Surgeons (GS), followed by minimal invasive surgeons (MIS) having advanced training in laparoscopy, Obstetricians and Gynecologists (OB-GYN), and Urologists.

Conclusion: The LS practice in Pakistan during the COVID-19 era is widely variable. There is a dire need to formulate apt local guidelines, that are practical and implementable in developing countries.

Keywords: Coronavirus disease-19, Health care professionals, Laparoscopic surgery, Minimally invasive surgery, Surgical smoke.

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Introduction

Since the start of the SARS-CoV-2 corona virus disease-19 (COVID-19) pandemic in 2019, the tally of patients suffering from the disease around the world has continuously increased with time. As of June 24th, 2022, the number of patients has risen to 547,492,681 globally, whereas 6,347,816 lives have been lost to this deadly pandemic.[1] Pakistan itself has seen 30,384 deaths as of June 24th, 2022, and with the first case of the much-feared sub-Omicron variant being reported recently, the pandemic is nowhere near its end.[2] Where COVID-19 has deteriorated the socioeconomic and political landscape of all the countries of the world, it has also changed the lives and practices of healthcare professionals (HCPs) for an indefinite amount of time.[3]

Due to the high risk of contracting the virus from patients, all HCPs are encouraged to always don personal protective equipment (PPE) and take safety precautions while handling patients suffering from COVID-19. The risk further increases with exposure to aerosol-generating procedures (e.g., endotracheal intubation, extubation, non-invasive ventilation, etc.) for at least 10 minutes at a distance of fewer than 2 meters from the patient.[4] Although the gains of LS for patients are established, there have been concerns regarding additional prospects of COVID-19 spread owing to the creation of pneumoperitoneum, use of energy devices, and diathermy during laparoscopy.[3] This has initiated an array of discussions from the use of energy devices and proper disposal of gases after insufflation to the use of filtration devices to curtail and limit the application of the laparoscopic approach during the COVID-19 pandemic.[5] Laparoscopy is employed in scores of acute surgical undertakings; however, information at hand on the risks for HCPs performing LS on COVID-19 positive or suspected cases is limited.

Numerous renowned societies and professional organizations of minimally invasive surgeons have issued guidelines on the preventive measures and the technical, mechanical, and procedural modifications to be taken during a laparoscopic undertaking for the safety of HCPs and theater staff.[6] This study aims to explore the practices of laparoscopic surgeons during this COVID-19 era to statistically evaluate their practices and awareness so that further steps can be recommended or devised on those grounds to improve the practices of laparoscopic surgeons in our local milieu amidst a rising fear of an increasing number of cases.

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Meterials and Methods

A cross-sectional, observational study was performed after IRB approval (IRB-1783/DUHS/Approval/2020) conducted from December 2020 to October 2021 via a purposive sampling technique. All surgeons performing laparoscopic surgeries in Pakistan were included in the study. Surgeons in training and those who had abandoned/stopped all types of operations during the COVID-19 pandemic were excluded from the study. Participants were requested through electronic communication channels, i.e., Surgical groups WhatsApp® and email groups, citing the link of the online semi-structured, pre-tested questionnaire by the investigators after consenting to participate in reading the online informed consent document. The identity of the participants and information retrieved from them was kept confidential.

Data was entered and analyzed by SPSS version 26. Frequency and percentages were calculated for qualitative data like gender, city of practice, academic association, and other responses while mean and standard deviation were calculated for quantitative data like age and years of practice. Stratification was done with reference to gender, teaching involvement, and specialties to control the effect modifier. The Chi-square test was put in application to appraise the impact of these on the outcome variables. The *p*-value < 0.05 was taken as significant.

Results

A total of 168 surgeons involved in LS from different disciplines responded to the invitation and filled out the online questionnaire. The mean age of the surgeons was 48.72 ± 8.04 years 146 (86.9%) of them were married and the majority belonged to the Major cities of the country, i.e., Karachi, Lahore, Multan, Islamabad, and Rawalpindi (Table 1). Surgeons who participated had a mean practice experience of 12.12 ± 6.88 years (minimum 3 and maximum 31 years). Most of the respondents were general surgeons (GS) performing basic laparoscopic procedures, followed by minimal invasive surgeons (MIS) having advanced laparoscopic training, Obstetricians and Gynecologists (OB-GYN), and Urologists. About 41% were practicing in the city of Karachi and the rest were distributed in other cities of Pakistan (Table 1). Only 28% were academic surgeons involved in teaching. More than half of the respondents have neither been associated with any Laparoscopic surgical association nor have read any LS guidelines for laparoscopic surgery during the COVID-19 pandemic (Table 1).

About 87% of surgeons were of the opinion that LS carries the additional risk of COVID-19 transmission while a little more than half agreed to have changed practice approaches during the COVID era. A total of 23 (13.7%) were only testing suspected patients for COVID before operating and the majority resorted to RT-PCR nasopharyngeal swabs for preoperative COVID screening. The choice of PPEs was also variable amongst surgeons with only a minority donning the N95 or respirator masks, eye protection, and coverall suits even during the peak of the pandemic. The availability of anesthesia gas scavenging systems (AGSS), negative pressure in the operating room (OR), smoke evacuation systems, and high-efficiency particulate air (HEPA) or ultra-low particulate air (ULPA) filter systems for laparoscopic surgeons were very limited. Only 30 (17.9%) practiced the recommendation of doing LS with lower intra-abdominal pressure than usual, i.e., <12 mm Hg. Minimizing the Trendelenburg position and avoiding the use of energy devices was also an uncommon practice, though, more than half (56%) of surgeons exercised exsufflating the pneumoperitoneum with vacuum suction before removing the ports for converting to open surgery or closure (Table 2).

Table 1: Demographics and characteristics

Variables	*Number (%)*
Specialty	
GS	98 (58.3%)
MIS	24 (14.3%)
OB-GYN	24 (14.3%)
Urologist	22 (13.1%)
City	
Karachi	69 (41.1%)
Lahore	32 (19%)
Hyderabad	22 (13.1%)
Multan	14 (8.3%)
Sialkot	12 (7.1%)
Islamabad and Rawalpindi	9 (5.4%)
Peshawar	9 (5.4%)
Sukkur	1 (0.6%)
Involved in teaching	
Yes	28 (16.7%)
No	140 (83.3%)
Member of laparoscopic association	
Yes	57 (33.9%)
No	111 (66.1%)
Which MIS guideline for COVID-19 have you read?	
SAGES	43 (25.6%)
IRCG	22 (13.1%)
EAES	9 (5.4%)
None	94 (56%)

Females (61.3%) and teaching surgeons (60.7%) were more statistically believing in additional risk of COVID transmission during LS while male surgeons (81%) and teaching surgeons (92.9%) were mandatorily doing preoperative COVID testing compared to female and non-academic surgeons with the difference reaching statistical significance (*p*-values < 0.05). The differences in practices with respect to gender and academic teaching affiliation are detailed in Table 3, whereas apart from preoperative COVID testing and working in HEPA/ULPA filter-installed ORs the rest were statistically similar between teaching versus non-teaching surgeons, but most of the questionnaire responses differed widely amongst gender groups as evident by the *p*-values.

Table 4 details the comparison of practices with respect to the specialties of participants, the Pearson Chi-square test for *p*-value showed that the practices were widely variable saving only two acts, i.e., use of the smoke evacuation system during LS and reducing the Trendelenburg tilt intentionally, which was not enacted routinely by all the subspecialties statistically (*p*-value > 0.05).

Discussion

The SARS-CoV-2 pandemic has brought attention to a neglected matter in recent times, that of aerosols and plume exposure-related

Table 2: Details of responses by surgeons

Questions	*Responses*	*Number (%)*
Does MIS carry additional risk of COVID-19 transmission?		
	Yes	87 (51.8%)
	No	42 (25%)
	Not sure	39 (23.2%)
Has your surgical practice changed during COVID era?		
	Yes	93 (55.4%)
	No	65 (38.7%)
	Only for COVID positive cases	10 (6%)
Have you made preoperative COVID testing mandatory?		
	Yes	121 (72%)
	No, only for suspected cases	23 (13.7%)
	My institute has a mandatory testing policy	24 (14.3%)
Which test do you advise preoperatively?		
	RT-PCR for COVID-19	137 (81.5%)
	COVID-19 antibodies	24 (14.3%)
	Rapid antigen	7 (4.2%)
Which mask do you use?		
	Surgical mask	103 (61.3%)
	KN95	34 (20.2%)
	N95	21 (12.5%)
	Full face respirator	10 (6%)
Do you wear eye protection equipment?		
	Yes	29 (17.3%)
	No	139 (82.7%)
Do you wear coverall suit?		
	Yes	10 (6%)
	No	158 (94%)
Does your OR have AGSS installed?		
	Yes	12 (7.1%)
	No	137 (81.5%)
	Don't know	19 (11.3%)
Does your OR have negative pressure system?		
	Yes	9 (8.3%)
	No	113 (64.3%)
	Don't know	46 (27.4%)
Do you use a smoke evacuation system while doing laparoscopic surgery?		
	Yes	9 (5.4%)
	No	159 (946%)
OR having HEPA or ULPA filter system		
	Yes	12 (7.1%)
	No	131 (78%)
	Don't know	25 (14.9%)
Maintaining intra-abdominal pressure lower than usual (<12 mm Hg)		
	Yes	30 (17.9%)
	No	115 (68.5%)
	Sometimes	23 (13.7%)
Change in position of the patient (minimizing the degree of Trendelenburg position)		
	Yes	10 (6%)
	No	158 (94%)
Avoiding use of energy devices		
	Yes	20 (11.9%)
	No	148 (88.1%)
Exsufflation of pneumoperitoneum using vacuum suction unit before closure or conversion		
	Yes	95 (56%)
	No	54 (32.1%)
	Sometimes	19 (11.3%)

risks to health during laparoscopy. Laparoscopy brings about the generation of aerosols as it requires the establishment and efficient pneumoperitoneum maintenance through CO_2 insufflation. A study found that after 10 minutes of laparoscopic dissection by ultrasound or electrosurgery, in comparison to dissection in open surgery, there was an elevation of the concentration of particles measuring 0.3–0.5 µm.[7] Also, there is a possible increased threat of transmission to HCPs in surgical theaters by laparoscopy due to gas leakage of the pneumoperitoneum which may hold suspended viruses in soaring concentration.[5] However, in the literature, only a small number of reports have related to this feared risk of transmission of viruses to the surgical team via inhalation from patients undergoing LS. Our findings revealed that only 51.8% of surgeons believed that LS carries an increased risk of COVID-19 transmission, out of which 61.3% were females and only 49.6% were males. About 55.8% of the surgeons admitted to having brought changes to their practices during the COVID-19 era.

DesCoteaux et al. demonstrated that the cautery smoke produced in the course of laparoscopic interventions has breathable aerosols and cell-size fragments.[8] It has very tiny particles (5%), diffused in water vapor (95%), that are not only able to go across the surgical masks but also inoculate the conjunctival layer in the eye.[8–10] Long before the COVID-19 pandemic, these understandings resulted in the proposal of advanced protective measures in the operating room (OR) like respirator masks, FFP2 or higher, sealing wrap goggles, and air filtration devices, though the implementation remained lacking largely.[9,11] The concentration of aerosolized particles lessens with the lowering of insufflation pressures and minimizing the duration and power of energy devices. The process of intubation, OR air pressure, intra-abdominal pressure, desufflater, smoke evacuation, and tissue extraction are some of the potential routes for viral contamination in the OR during LS, the most potent of which is intubation and extubation.[12]

RT-PCR for COVID-19 is strongly recommended for testing of surgical patients before operative interventions; however, 10–30% false-negative rate precludes guaranteeing non-infectivity.[13] For this reason, wearing complete PPE, limiting elective hospitalizations, and spacing surgeries with keeping 30 minutes 1 hour between them is recommended.[5,13–15] The International Endoscopic Surgery Societies have been propounding the risk of aerosolization of particles in advocacy to avoid laparoscopic approach in COVID-19-positive and suspected patients, which has led to preventive measures being defined more coherently with time. These include

Table 3: Comparison of practices with reference to gender and teaching involvement

		Gender			*Involved in teaching*		
Questions	*Responses*	*Male number (%)*	*Female number (%)*	*p-value*	*Yes number (%)*	*No number (%)*	*p-value*
Does LS carry additional risk of COVID-19 transmission?							
	Yes	68 (49.6%)	19 (61.3%)	0.001*	17 (60.7%)	70 (50%)	0.04*
	No	42 (30.7%)	0 (0%)		11 (39.3%)	31 (22.1%)	
	Not sure	27 (19.7%)	12 (38.7%)		0 (0%)	39 (27.9%)	
Has your surgical practice changed during COVID era?							
	Yes	71 (51.8%)	22 (71%)	0.088	15 (53.6%)	78 (55.7%)	0.281
	No	56 (40.9%)	9 (29%)		13 (46.4%)	52 (37.1%)	
	Only for COVID positive cases	10 (7.3%)	0 (0%)		0 (0%)	10 (7.1%)	
Have you made preoperative COVID testing mandatory?							
	Yes	111 (81%)	10 (32.3%)	0.000*	26 (92.9%)	95 (67.9%)	0.02*
	No, only for suspected cases	14 (10.2%)	9 (29%)		0 (0%)	23 (16.4%)	
	My institute has a mandatory testing policy	12 (8.8%)	12 (38.7%)		2 (7.1%)	22 (15.7%)	
Which test do you advise preoperatively?							
	RT-PCR for COVID-19	118 (86.1%)	19 (61.3%)	0.000*	26 (92.9%)	111 (79.3%)	0.209
	COVID-19 antibodies	12 (8.8%)	12 (38.7%)		2 (7.1%)	22 (15.7%)	
	Rapid antigen	7 (5.1%)	0 (0%)		0 (0%)	7 (5%)	
Which mask do you use?							
	Surgical mask	72 (52.6%)	31 (100%)	0.000*	19 (67.9%)	84 (60%)	0.117
	KN95	34 (24.8%)	0 (0%)		3 (10.7%)	31 (22.1%)	
	N95	21 (15.3%)	0 (0%)		6 (21.4%)	15 (10.7%)	
	Full face respirator	10 (7.3%)	0 (0%)		0 (0%)	10 (7.1%)	
Do you wear eye protection equipment?							
	Yes	29 (21.2%)	0 (0%)	0.05	2 (7.1%)	27 (19.3%)	0.121
	No	108 (78.8%)	31 (100%)		26 (92.9%)	113 (80.7%)	
Do you wear coverall suit?							
	Yes	0 (0%)	10 (32.3%)	0.000*	2 (7.1%)	8 (5.7%)	0.771
	No	137 (100%)	21 (67.7%)		26 (92.9%)	132 (94.3%)	
Does your OR have AGSS installed?							
	Yes	12 (8.8%)	0 (0%)	0.000*	2 (7.1%)	10 (7.1%)	0.115
	No	118 (86.1%)	19 (61.3%)		26 (92.9%)	111 (79.3%)	
	Don't know	7 (5.1%)	12 (38.7%)		0 (0%)	19 (13.6%)	
Does your OR have negative pressure system?							
	Yes	9 (6.6%)	0 (0%)	0.173	4 (14.3%)	5 (3.6%)	0.071
	No	94 (68.6%)	19 (61.3%)		17 (60.7%)	96 (68.6%)	
	Don't know	34 (24.8%)	12 (46%)		7 (25%)	39 (27.9%)	
Do you use a smoke evacuation system while doing laparoscopic surgery?							
	Yes	0 (0%)	9 (29%)	0.000*	0 (0%)	9 (6.4%)	0.168
	No	137 (100%)	22 (71%)		28 (100%)	22 (93.6%)	
OR having HEPA or ULPA filter?							
	Yes	0 (0%)	12 (38.7%)	0.000*	0 (0%)	12 (8.6%)	0.033*
	No	112 (81.8%)	19 (61.3%)		20 (71.4%)	111 (79.3%)	
	Don't know	25 (18.2%)	0 (0%)		7 (28.6%)	17 (12.1%)	
Maintaining intrabdominal pressure lower than Usual (<12 mm Hg)?							
	Yes	20 (14.6%)	10 (32.3%)	0.000*	5 (17.9%)	25 (17.9%)	0.995
	No	103 (75.2%)	12 (38.7%)		19 (67.9%)	96 (68.6%)	
	Sometimes	14 (10.2%)	9 (29%)		4 (14.3%)	19 (13.6%)	

(Contd...)

Table 3: *(Contd...)*

		Gender			Involved in teaching		
Questions	*Responses*	*Male number (%)*	*Female number (%)*	*p-value*	*Yes number (%)*	*No number (%)*	*p-value*
Change in position of the patient (minimizing the degree of Trendelenburg position)?							
	Yes	10 (7.3%)	0 (0%)	0.121	1 (3.6%)	9 (6.4%)	0.560
	No	127 (92.7%)	31 (100%)		27 (96.4%)	131 (93.6%)	
Avoiding use of energy devices?							
	Yes	20 (14.6%)	0 (0%)	0.023*	3 (10.7%)	17 (12.1%)	0.831
	No	117 (85.4%)	31 (100%)		25 (89.3%)	123 (87.9%)	
Exsufflation of pneumoperitoneum using vacuum suction unit before closure or conversion?							
	Yes	75 (54%)	21 (67.7%)	0.000*	16 (57.1%)	79 (56.4%)	0.120
	No	54 (39.4%)	0 (0%)		6 (21.4%)	48 (34.3%)	
	Sometimes	9 (6.6%)	10 (32.3%)		6 (21.4%)	13 (9.3%)	

*p-value < 0.05 denoting statistical significance. Involve in teaching = Academic surgeons involved in teaching and training undergraduate and postgraduate students

Table 4: Comparison of practices in between specialties

		Specialty				
Questions	*Responses*	*GS number (%)*	*MIS number (%)*	*OB-GYN number (%)*	*Urologists number (%)*	*p-value*
Does MIS carry additional risk of COVID-19 transmission?						
	Yes	61 (62.2%)	15 (62.5%)	11 (45.8%)	0 (0%)	0.000*
	No	24 (24.5%)	5 (20.8%)	1 (4.2%)	12 (54.4%)	
	Not sure	13 (13.3%)	4 (16.7%)	12 (50%)	10 (45.5%)	
Has your surgical practice changed during COVID era?						
	Yes	48 (49%)	10 (41.7%)	23 (95.8%)	12 (54.5%)	0.000*
	No	50 (51%)	14 (58.3%)	1 (4.2%)	0 (0%)	
	Only for COVID positive cases	0 (0%)	0 (0%)	0 (0%)	10 (45.5%)	
Have you made preoperative COVID testing mandatory?						
	Yes	75 (76.5%)	24 (100%)	12 (50%)	10 (45.5%)	0.000*
	No, only for suspected cases	23 (23.5%)	0 (0%)	0 (0%)	0 (0%)	
	My institute has a mandatory testing policy	0 (0%)	0 (0%)	12 (50%)	12 (54.5%)	
Which test do you advise preoperatively?						
	RT-PCR for COVID-19	91 (92.9%)	24 (100%)	12 (50%)	10 (45.5%)	0.000*
	COVID-19 antibodies	0 (0%)	0 (0%)	12 (50%)	12 (54.5%)	
	Rapid antigen	7 (7.1%)	0 (0%)	0 (0%)	0 (0%)	
Which mask do you use?						
	Surgical mask	55 (56.1%)	15 (62.5%)	23 (95.8%)	10 (45.5%)	0.000*
	KN95	28 (28.6%)	5 (20.8%)	1 (4.2%)	0 (0%)	
	N95	9 (9.2%)	0 (0%)	0 (0%)	12 (54.5%)	
	Full face respirator	6 (6.1%)	4 (16.7%)	0 (0%)	0 (0%)	
Do you wear eye protection equipment?						
	Yes	13 (13.3%)	4 (16.7%)	0 (0%)	12 (54.5%)	0.000*
	No	85 (86.7%)	20 (83.3%)	24 (100%)	10 (45.5%)	
Do you wear coverall suit?						
	Yes	0 (0%)	0 (0%)	10 (41.7%)	0 (0%)	0.000*
	No	98 (100%)	24 (100%)	14 (58.3%)	22 (100%)	
Does your OR have AGSS installed?						
	Yes	0 (0%)	0 (0%)	0 (0%)	12 (54.5%)	0.000*
	No	91 (92.9%)	24 (100%)	12 (50%)	10 (45.5%)	
	Don't know	7 (7.1%)	0 (0%)	12 (50%)	0 (0%)	

(Contd...)

Table 4: *(Contd...)*

		Specialty				
Questions	*Responses*	*GS number (%)*	*MIS number (%)*	*OB-GYN number (%)*	*Urologists number (%)*	*p-value*
Does your OR have negative pressure system?						
	Yes	4 (4.1%)	5 (20.8%)	0 (0%)	0 (0%)	0.000*
	No	76 (77.6%)	14 (58.3%)	11 (45.8%)	12 (54.5%)	
	Don't know	18 (18.4%)	5 (20.8%)	13 (54.2%)	10 (45.5.%)	
Do you use a smoke evacuation system while doing laparoscopic surgery?						
	Yes	9 (9.2%)	0 (0%)	0	0 (0%)	0.079
	No	89 (90.8%)	24 (100%)	24 (100%)	22 (100%)	
OR having HEPA or ULPA filter						
	Yes	0 (0%)	0 (0%)	12 (50%)	0 (0%)	0.000*
	No	78 (79.6%)	19 (79.2%)	12 (50%)	22 (100%)	
	Don't know	20 (20.4%)	5 (20.8%)	0 (0%)	0 (0%)	
Maintaining intrabdominal pressure lower than usual (<12 mm Hg)						
	Yes	20 (20.4%)	0 (0%)	10 (41.7%)	0 (0%)	0.000*
	No	55 (56.1%)	24 (100%)	14 (58.3%)	22 (100%)	
	Sometimes	23 (23.5%)	0 (0%)	0 (0%)	0 (0%)	
Change in position of the patient (minimizing the degree of Trendelenburg position)						
	Yes	10 (10.2%)	0 (0%)	0 (0%)	0 (0%)	0.055
	No	88 (89.8%)	24 (100%)	24 (100%)	22 (100%)	
Avoiding use of energy devices						
	Yes	20 (20.4%)	0 (0%)	0 (0%)	0 (0%)	0.001*
	No	78 (79.6%)	24 (100%)	24 (100%)	22 (100%)	
Exsufflation of pneumoperitoneum using vacuum suction unit before closure or conversion						
	Yes	73 (74.5%)	9 (37.5%)	13 (54.2%)	0 (0%)	0.000*
	No	21 (21.4%)	10 (41.7%)	1 (4.2%)	22 (100%)	
	Sometimes	4 (4.1%)	5 (20.8%)	10 (41.7%)	0 (0%)	

*p-value < 0.05 denoting statistical significance. GS, general surgeons; MIS, minimally invasive surgeons; OB-GYN, obstetricians and gynecologists

appropriate PPE, proper room filtration, ventilation, and installation of smoke evacuation–filtration system.[5,14] Wong et al. stressed on using certified N95 respirators, face shields or eye goggles in addition to routine protective gadgets.[16] Owing to the possibility of transmission even with N95 masks, employing a powered air purifying respirator (PAPR) during procedures involving the generation of aerosols when operating on COVID-positive or suspected-positive cases is strongly recommended. Repici and colleagues advocated advanced measures and novel equipment for protection in endoscopic undertakings.[17] The Zhejiang University School of Medicine's Handbook of COVID-19 Prevention and Treatment gives an account of vital findings and essence from the initial waves advising level III protection during all kinds of surgeries, ORs with negative pressure systems with some other precautionary measures.[18] All aforementioned studies place special emphasis on the significance of protecting HCPs with apt PPE, be they examining or operating upon the patients. According to our findings, only 12.5% of surgeons wore N95 masks during surgeries, while 61.3% wore surgical masks which don't provide sufficient protection. Notable, 52.6% of male surgeons used surgical masks, 24.8% KN95, 15.3% N95, and a full face respirator were worn by 7.3%, in contrast, all-female surgeons (100%) chose to wear surgical masks. Furthermore, only 17.3% of all surgeons wore eye protection (21.2% males and 0% females) and only 6% wore protective cover all suits (32.3% females and 0% males). Even though these findings are statistically significant, they point towards a much larger lack of adherence to existing guidelines for protection against COVID-19 transmission.

A negative pressure OR environment prevents air from escaping the OR, making it the perfect tool for preventing virus transmission.[16] Operating in a negative pressure system installed ORs was among the common and strong recommendations of both the American Society of Gastrointestinal Endoscopy and the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES).[19,20] Wax and Christian also concurred with this and included it in their set of practical recommendations.[21] A review of the preparedness of OR measures and responses in COVID-19 from anesthetists of Singapore General Hospital entailed their efforts of making dedicated ORs with committed ventilation systems and HEPA filters for COVID-19 suspected and diseased patients. Maintaining a single entry and exit route through the scrubbing lobby and implementing locked-OR doors protocol during surgical interventions were part of a plan to reduce transmission by controlling traffic and airflow.[16] However, unfortunately, only 8.3% of surgeons in our study reported working in negative-pressure ORs despite the existence of formal guidelines, hence highlighting an infrastructural weakness in healthcare systems that needs to be given focused attention in order to minimize transmission of SARS-CoV-2.

Previous researchers have demonstrated the toxic potential of surgical smoke alongside several other plausible risks during

operative interventions.[10] This is especially relevant when laser aerosolizes contaminated tissue rich in infectious living and dead agents. The expected debris produced from different types of energy devices commonly employed in open and minimally invasive abdominal operations namely Ultrasonic scalpel, laser ablation, and electrocautery are 0.35–6.5 microns, 0.3 microns, and less than 0.1 microns respectively.[22] Even though the exact potential of coronavirus to aerosolize in the abdomen is not known, abstaining from electrosurgical dissection and certain energy devices, e.g., ultrasonic scalpel, may reduce the danger of viral emission by reducing particle aerosolization. Moreover, surgical smoke filtration systems have proven to be beneficial in protecting against the infectious potential of SARS-Cov-2. Given that the virus size ranges from 0.070 to 0.075 µm, the recommended filters are HEPA, with an efficiency of 99.97% in removing particles > 0.03 µm diameter or ULPA filters, which can filter particles > 0.05 µm size. All surgical societies (SAGES, EAES, AMASI, IAGES) have adopted a set of measures to minimize the emission of aerosols during the intervention, consisting of the reduced pressure of the pneumoperitoneum, tight incisions to prevent leakage at the trocar orifices, minimum use of energy devices and use of cold hemostasis whenever possible, and integrated insufflation devices comprising smoke evacuation and filtration mode (HEPA/ULPA).[6,23–26] According to our data, only 5.3% of surgeons reported having used smoke evacuation systems during laparoscopic surgeries, only 7.1% reported having used HEPA or ULPA filters, and only 11.9% had avoided the use of energy devices. Unfortunately, discrepancies also existed between the practices of male and female surgeons as evident by the fact that 29% of female surgeons reported using smoke evacuation systems against an alarming 0% of male surgeons. Furthermore, 38.7% of female surgeons reported using HEPA/ULPA filters against yet another 0% of male surgeons. On the other hand, 14.6% of male surgeons interestingly reported avoiding the use of energy devices against 0% of female surgeons.

The debate on whether to prefer open surgery or LS during the pandemic will probably go on, but the gist of it can be understood by the fact that the Royal College of Surgeons of England had advocated caution for surgeons in considering LS, and the Society of American Gastrointestinal and Endoscopic Surgeon (SAGES) had recommended filtering released CO_2 by employing apt filter systems during LS and robotic surgery.[6,27] On the contrary, the Association of Laparoscopic Surgeons of Great Britain and Ireland (ALSGBI) backed the use of the laparoscopic approach while the American College of Surgeons was of the opinion that in light of insufficient statistical evidence to propound for or against preferring open over LS approach, surgeons should bank on the approach with lesser operative duration and maximum safety.[28,29] Considering the differences in the practices of surgeons on multiple strata described in our study, and the lack of an established consensus on the link of LS to COVID-19 transmission, it is clear that there needs to be a collective effort by all stakeholders in healthcare to adhere to international guidelines for LS during COVID-19 as the slightest violation of the precautions or a lack of compliance may pose a significant danger for the entire OR staff, causing them additional psychological stress. On this ground, it would be worthwhile to limit the traffic of personnel in the OR, abstain from complex and complicated maneuvers, and assign experienced personnel.[5,14,15]

Conclusion

The COVID-19 era has had a widespread effect on surgical practice and the healthcare system. This study shows the wide variation in LS practices and the lack of adherence to the recommendations of international Laparoscopic Surgical Associations in Pakistan. We feel that there is a dire need for efforts to establish a consensus and formulate practical local guidelines for surgeons involved in LS, tailored to the country's healthcare system.

Clinical Significance

As a result of COVID-19, Pakistan has not only experienced a change in surgical practices in healthcare settings but has also struggled to provide the equipment and infrastructure necessary to adhere to various international guidelines. Our data only shows a glimpse of this situation in Pakistan and other developing countries, calling for combined efforts to raise awareness, establishing suitable OR environments with safety systems, and devising and implementing local and regional consensus guidelines.

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