Effect of coronavirus disease 2019 pandemic on cardiothoracic hospitalization rates and emergency services: the collateral damage

Mohammed Abd Al Jawad[a], Hoda Shokri[b], Ihab Ali[a]

Departments of [a]Cardio-thoracic Surgery, [b]Anesthesiology, Ain Shams University, Cairo, Egypt

Correspondence to Ihab Ali, MD, PhD, FRCS (C-Th), Department of Cardio-thoracic Surgery, Ain Shams University, 392 Ramses St., Abbassia, Cairo, 11355, Egypt. Tel: 26829958; Fax: (+202)26845174; e-mail: ihab_abdelrazek@med.asu.edu.eg

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Background
The recent coronavirus disease 2019 (COVID-19) pandemic has taken a great toll on the already strained healthcare services. In this study, we aim to evaluate the effect of the COVID-19 pandemic on hospitalization rates for cardiac emergencies in our high-flow tertiary center.
Patients and methods
A retrospective nonrandomized descriptive study was conducted on urgent and emergency cardiovascular hospitalization rates from October 2019 to September 2020, which were compared with the data from the same time of the previous year.
Results
The total number of patients with acute mechanical valve thrombosis significantly decreased from 11 patients in the year before the pandemic to only one in April 2020 ($P<0.001$). Acute type A aortic dissection patient numbers decreased significantly from 16 to eight patients ($P<0.05$). Lastly, both urgent and emergency thoracic procedures decreased significantly during the COVID-19 year, which was evident from April to July 2020 ($P<0.001$).
Conclusions
Critical healthcare conditions should not be overshadowed by newly emerging pandemics. Future developed healthcare strategies should accommodate the increasing numbers of patients and ensure a reliable 'safe zone' for patients to avoid nosocomial infections.

Keywords:
cardiovascular disease, coronavirus disease 2019, hospitalization rates, urgent and emergency

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Introduction

The coronavirus disease 2019 (COVID-19) pandemic is one of the greatest challenges encountered by health service providers worldwide in the past few decades. It is caused by the SARS-CoV-2 virus and primarily affects the lower respiratory system, leading to interstitial pneumonia and adult respiratory distress syndrome. The morbidity and mortality risk from COVID-19 increases with advancing age, male biology, and preexisting medical conditions like cardiovascular diseases, hypertension, and diabetes. Individuals possessing these characteristics are prone to a higher incidence of cardiovascular complications from the virus [1].

The association between acute coronary syndrome and COVID-19 infection is still unclear; the infection may aggravate the inflammatory responses, leading to cytokines storm, which may cause plaque disruption. These complications occur alongside viral thrombosis conditions, which may practically lead to increased presentations of coronary complications [2,3]. Hospital admissions for coronary and cardiovascular conditions were markedly and unexpectedly reduced in several reports arising from various countries [4].

Several healthcare administrations reduced their range of services to brace themselves against the effect of COVID-19. Many even limited their service provisions to emergency cases only, enabling them to direct more staff and resources against the first wave of the virus [5]. This strategy of diversion may come with its own collateral damage, such as delayed presentations, diagnosis, and management of certain critical cardiovascular conditions. In this study, we aim to evaluate the effect of the COVID-19 pandemic on hospitalization rates for cardiothoracic emergencies in our high-flow tertiary center.

Ain Shams University Cardiothoracic Hospital is considered the largest dedicated cardiac center in Eastern part of Cairo, with an average 1200 cardiovascular and 450 thoracic surgeries annually. The center has a dedicated aortic surgery, infective endocarditis, and TAVI programs.

Patients and methods

A retrospective nonrandomized descriptive study was conducted among patients hospitalized for an urgent cardiac care or emergency between October 2019 (first month of worldwide virus detection reports) and end of September 2020. This study was approved by the Research Ethics Committee (REC) at the Faculty of Medicine, Ain Shams University FWA 000017585, FAMSU R 101 /2020 by which waiver consent was obtained.

Emergency cases were defined as those requiring immediate intervention within the first 24 h of admission, whereas urgent cases comprised those requiring intervention within the same hospital admission. The hospitalization rates for the same period in the previous year were used as the control data. Patients were primarily classified depending on the procedures required: thoracic, congenital cardiac, and adult cardiac.

Statistical analysis

The present study data were analyzed using descriptive statistics. Furthermore, unpaired Student *t* tests were used to compare the hospitalization rates between the different years quantitatively. The IBM SPSS (IBM) [Statistical Package for Social Science SPSS (SPSS Inc., Chicago, IL, USA)] was used for data analysis. Statistical significance was set at *P* value less than 0.05.

Results

Data analysis revealed that total emergency and urgent adult admissions yearly did not decrease significantly, except in April–June 2020 (56 patients in the pre-COVID era, and 11 patients in the COVID era, $P<0.001$).

Similarly, the urgent total adult admissions reported no significant reduction, except for April–June 2020 (49 patients in the pre-COVID era and 10 patients in the COVID era, $P<0.001$). On the contrary, the total emergency adult admissions reported significant reductions (seven patients in the pre-COVID era and one patient in the COVID era, $P<0.001$).

Further analysis of emergency adult procedures, namely, acute mechanical valve thrombosis and acute Stanford type A aortic dissection revealed certain interesting findings, as follows.

The total number of acute mechanical valve thrombosis was significantly reduced from 11 patients in the year before the pandemic to only one patient admitted in April 2020 ($P<0.001$; Table 1, Fig. 1). Similarly, significant reduction was observed in acute type A aortic dissection from 16 to eight patients ($P<0.05$; Table 2, Fig. 2).

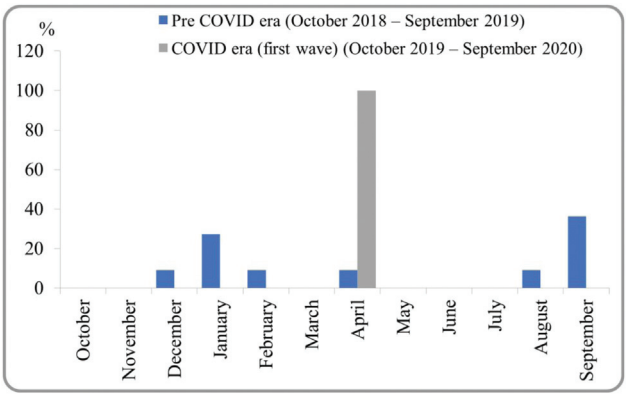
Coronary care unit (CCU) admissions, primary percutaneous coronary intervention (PCI) procedures, and urgent coronary artery bypass grafting (CABG) were collectively referred to as 'coronary interventions.' There has been a significant reduction in patients throughout the year (CCU: 771–717, $P<0.05$; primary PCI: 380–162, $P<0.001$;

Table 1 Acute mechanical valve thrombosis

Months	Pre-COVID era (October 2018–September 2019) [*n* (%)]	COVID era (first wave) (October 2019–September 2020) [*n* (%)]	χ^2	
			χ^2	*P* value
October	0	0		
November	0	0		
December	1 (9.1)	0	2.000	0.157
January	3 (27.3)	0	6.000	0.014*
February	1 (9.1)	0	2.000	0.157
March	0	0		
April	1 (9.1)	1 (100.0)	0.000	>0.99
May	0	0		
June	0	0		
July	0	0		
August	1 (9.1)	0	2.000	0.157
September	4 (36.4)	0	8.000	0.005*
Total	11 (100.0)	1 (100.0)	16.667	<0.001*

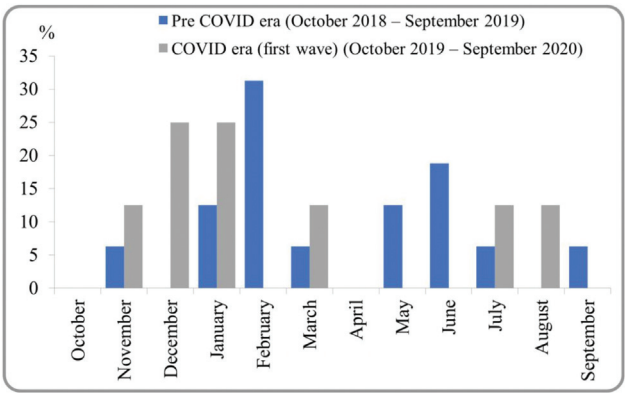
COVID, coronavirus disease. *Statistically significant.

Figure 1



Acute mechanical valve thrombosis.

Figure 2



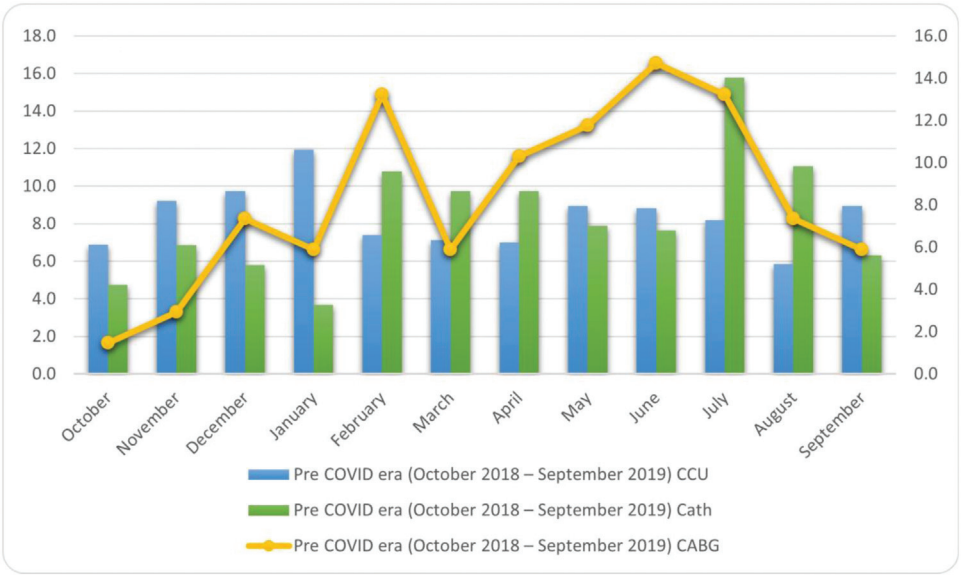
Acute Stanford type A aortic dissection.

Table 2 Acute Stanford type A aortic dissection

Month	Pre-COVID era (October 2018–September 2019) *N* (%)	COVID era (first wave) (October 2019–September 2020) *N* (%)	χ^2	
			χ^2	*P* value
October	0	0		
November	1 (6.3)	1 (12.5)	0.000	>0.99
December	0	2 (25.0)	4.000	0.046*
January	2 (12.5)	2 (25.0)	0.000	>0.99
February	5 (31.3)	0	10.000	0.002*
March	1 (6.3)	1 (12.5)	0.000	>0.99
April	0	0		
May	2 (12.5)	0	4.000	0.046*
June	3 (18.8)	0	6.000	0.014*
July	1 (6.3)	1 (12.5)	0.000	>0.99
August	0	1 (12.5)	2.000	0.157
September	1 (6.3)	0	2.000	0.157
Total	16 (100.0)	8 (100.0)	5.333	0.021*

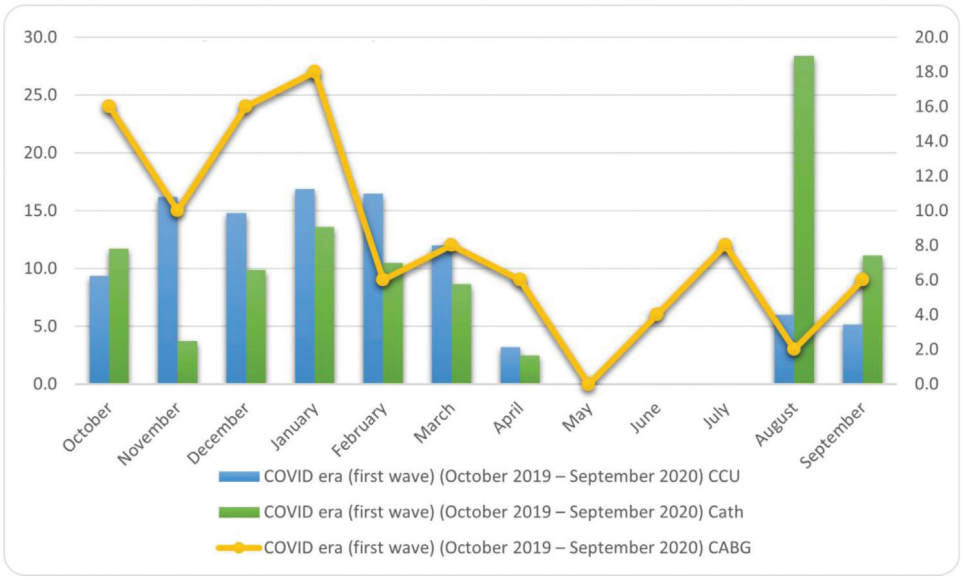
COVID, coronavirus disease. *Statistically significant.

Figure 3



Acute coronary admissions (pre-COVID era, 2018–2019). COVID, coronavirus disease.

Figure 4



Acute coronary admissions (COVID first wave, 2019–2020). COVID, coronavirus disease.

and CABG: 68–50, $P<0.05$). This reduction even reached a zero-admission rate for CCU and PCI, and ~55–100% reduction for CABG, during May–July 2020 (Figs 3 and 4, Table 3 Supplemental Table 1).

Discussion

According to the WHO, 'cluster cases of atypical viral pneumonia' were officially detected first in late December 2019, whereas the zero patient was identified as early as October or November 2019. The first official COVID-19 case outside mainland China was detected in January 2020. This was followed by the initial case reports in Europe and United States in late January 2020. Egypt confirmed its first case in mid-February 2020 [6].

The first wave of the pandemic was in March, April, and the first half of May 2020 for many European countries, including Italy [7], whereas in Egypt, the first wave lasted through May, June, and the early half of July 2020 [8]. Egypt took extensive partial and complete lockdown measures from mid-March to the end of June 2020. This sheds light on the specific duration highlighted in this study.

Reports suggest a noticeable reduction in cardiothoracic ER admissions globally [9]. This significant decrease left many healthcare providers with the puzzling question of 'where have all those emergency and urgent patients gone?'

Several possible explanations have been proposed for this reduction of patient flow: (a) fear of contracting the virus. Patients may be afraid of getting infected, during transportation or hospital admission, thereby choosing to stay at home, self-manage symptoms, and wait for the restrictions to be lifted. (b) Fear of social stigma. Initial reported cases were severely stigmatized owing to the lack of awareness about the pandemic. (c) Fear of being a family burden. This reason was especially stronger among the geriatric population [10]. (d) Some authors suggested that the resulting lockdown and the pandemic restricted hospital access owing to physical limitations and overcrowding of infected patients in ER departments. (e) The lockdown may have led to strict social distancing and minimal exercise indoors, which could have resulted in lower exertional activity and therefore, lower incidence of cardiovascular conditions. (f) Some authors suggested that the irregular neurological responses owing to the viral infection may have altered the perception of chest pain. (g) Many professionals believe that the lack of consensus among public health professionals about COVID-19 precautions, the failure of media to highlight coronary problems, and public misinformation may have contributed to the hospitalization rate reduction experienced during the pandemic [10].

As rheumatic fever is a major concern among young Egyptian patients, mechanical valve replacements are central in all valve interventions in our center [11]. It has increased the agonizing emergency thrombotic mechanical valve failure. This study observed a substantial reduction in acute valve thrombosis from 11 patients in the pre-COVID-19 year to only one in the COVID-19 era. Although COVID-19 may have

Table 3 Acute coronary admissions

Month	CCU				CABG				Cath			
	2018–2019	2019–2020	χ^2	*P* value	2018–2019	2019–2020	χ^2	*P* value	2018–2019	2019–2020	χ^2	*P* value
October	53	67	3.267	0.071	1	8	10.889	<0.001*	18	19	0.054	0.816
November	71	116	21.658	<0.001*	2	5	2.571	0.109	26	6	25.000	<0.001*
December	75	106	10.619	<0.001*	5	8	1.385	0.239	22	16	1.895	0.169
January	92	121	7.897	0.005*	4	9	3.846	0.050*	14	22	3.556	0.059
February	57	118	42.526	<0.001*	9	3	6.000	0.014*	41	17	19.862	<0.001*
March	55	86	13.631	<0.001*	4	4	0.000	>0.99	37	14	20.745	<0.001*
April	54	23	24.961	<0.001*	7	3	3.200	0.074	37	4	53.122	<0.001*
May	69	0	138.000	<0.001*	8	0	16.000	<0.001*	30	0	60.000	<0.001*
June	68	0	136.000	<0.001*	10	2	10.667	<0.001*	29	0	58.000	<0.001*
July	63	0	126.000	<0.001*	9	4	3.846	0.050*	60	0	120.000	<0.001*
August	45	43	0.091	0.763	5	1	5.333	0.021*	42	46	0.364	0.546
September	69	37	19.321	<0.001*	4	3	0.286	0.593	24	18	1.714	0.190
Total	771	717	3.919	0.048*	68	50	5.492	0.019*	380	162	175.365	<0.001*

CABG, coronary artery bypass grafting; CCU, coronary care unit. *Statistically significant.

primarily caused this, technology may have served us well. Telemedicine services in our center and instant messaging applications allowed the patients to be in direct contact with their healthcare providers; these mediums spared the patients from the agony of traveling distances to get coagulation profile checks. Similarly, many studies reported the existence of 'virtual clinics,' with limited access to and exhaustion of dedicated medical staff being the hindrances [5].

El-Hamamsy *et al.* [12] reported a 76.5% reduction in acute type A aortic dissection cases of 11 cardiac surgery centers in New York, USA. This decline was more pronounced in the successive months of March and April 2020. This has been around the same time of the first coronavirus-infected patient on March 5, 2020. This finding is consistent with the 50% decline in the acute presentations in our study.

Acute coronary interventions are a little bit different as they are closely related to emotionally stressful national events. Increased rates of cardiovascular hospitalizations have been observed during major terrorist attacks, wars, natural disasters, and even major sports events [13]. The COVID-19 era has produced many contradictory reports of decreased admission rates for acute coronary syndrome worldwide [4,14–16].

Thus, along with investing in an effective network of telemedicine services and establishing dedicated virtual clinics, several other hospital management strategies are needed to cope with and adapt to the pandemic. In Egypt, some administrations preferred completely segregated hospitals for isolating COVID-19-infected patients and other 'COVID-free' hospitals; other administrations adopted the 'separated tracks' method, by manually creating red/green pathways within the same hospital. The disadvantage of the latter is the intermix of medical staff themselves in recreational rooms. These 'COVID-free' hospitals may serve as safe houses for critically ill patients, by ensuring them a 'safe clean environment' against COVID-19, for managing their life-threatening conditions before grave complications occur.

Our center in Cairo set a protocol that all urgent patients were required to undergo a PCR test, whereas a rapid test was mandatory for all emergency admissions. Emergency departments should especially strictly adhere to infection-control

recommendations, such as screening protocols and establishment of well-ventilated triage areas for patients with and without COVID-19 symptoms [9].

For these purposes, the population should gain wider exposure to health messages through intensive media campaigns, which highlight the importance of seeking immediate medical advice for serious conditions like chest pains; visits to the emergency department for such conditions should never be avoided [9].

Some authors have provided warnings suggesting that if multiple strategies are not adopted to encourage patients with serious cardiovascular symptoms to seek medical advice during the periods of lockdown, the health system should expect an outburst of cases with late cardiovascular complications of myocardial infarction, when the lockdown eases or ends [16].Although the American College of Surgeons and the American Society of Anesthesiologists recommended that a reduction in new COVID-19-infected patients should be awaited before initiating elective surgeries, Keskin *et al*. [17] suggested that cardiovascular interventions, including open heart surgery, can be performed safely with acceptable morbidity and mortality rates during the pandemic era. They listed additional recommendations, such as controlling emergency department triage and traffic, careful preoperative and postoperative evaluation of patients, adequate use of PPE materials and kits, and strict disinfection protocols of equipment and wards, as effective measures to achieve that goal [17].

Therefore, investments in expensive, well-equipped, disaster-ready, and financially stable healthcare services are no longer a luxury but a matter of existence. This study is limited by its data collected, as it was derived from a single center, with only 1 year of data for control. The lack of accuracy of the at-home death reports may contribute to the limitations.

Conclusions

Healthcare services should be ready to face newly emerging challenges. Although a great amount of attention is warranted toward newer pandemics, this should not overshadow other life-threatening conditions.

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Conflicts of interest

There are o conflicts of interest.

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