Management Trends in the Cath Lab During the COVID-19 Period, an Egyptian Survey

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Abstract: The World Health Organization (WHO) announced that the novel coronavirus pneumonia pandemic caused by SARS-CoV-2 was classified as a public health emergency of international concern on January 30, 2020 Egypt's health ministry had announced the first case in the country at Cairo International Airport involving a Chinese national on 14 February 2020. Case decisions in the cath labs should be individualized, taking into account the risk of 2019 novel coronavirus (COVID-19) exposure versus the risk of delay in diagnosis or therapy. In patients with known or suspected COVID-19 and ischemic heart disease, the balance of staff exposure and patient benefit will need to be weighed carefully. *Aim of the work:* Analyzing and assessing the impact of COVID 19 pandemic on the: (1) volume, type of patients, and the different procedures performed. (2) The changes in management trends of cardiologists in the cath labs. *Results:* This study has surveyed 30 cath labs distributed all over Egypt during COVID-19 pandemic with 43.35% in urban area and 56.7% in rural areas. Only 63.3% of surveyed centers were well equipped to deal with COVID-19 active patients and full personal protective equipment was worn in only 6.7% of patients. A decrease in the volume of new acute coronary syndrome (ACS) patients, ST-elevation myocardial infarction patients and primary percutaneous coronary intervention (PCI) was recorded

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in 80%, 83%, and 80% of the surveyed centers respectively. Regarding the delay in the invasive management for patients with ACS due to diagnostic testing, there was 100% delay in all surveyed centers with 70% of centers suffering from delay in primary PCI due to awaited testing. On the other hand, there was a decrease in the volume of patients receiving elective procedures in 83.3% of cath labs. *Conclusion:* The management trends in the current Egyptian survey were significantly impacted during COVID-19 pandemic. Primary PCI volume much reduced and takes longer time than should be. (Curr Probl Cardiol 2021;46:100715.)

Introduction

In December 2019, many cases of pneumonia of unknown origin had appeared in Wuhan, China.[1] On February 11, 2020, the virus was named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) by the International Committee on Taxonomy of Viruses (ICTV). The World Health Organization (WHO) announced that the novel coronavirus pneumonia pandemic caused by SARS-CoV-2 was classified as a public health emergency of international concern on January 30, 2020. The new coronavirus disease caused by SARS-CoV-2 was named coronavirus disease 2019 (COVID-19). As of March 9, 2020, the pandemic has spread to >100 countries worldwide.[2] A comprehensive strategy, including surveillance, diagnostics, clinical treatment, research, and development of vaccines and drugs, is urgently needed to win the battle against COVID-19 and other infectious diseases.

Egypt's health ministry had announced the first case in the country at Cairo International Airport involving a Chinese national on February 14, 2020.[3,4] Egyptian authorities had notified the WHO and the patient had been placed in quarantined isolation in hospital.[5]

Case decisions in the cath labs should be individualized, taking into account the risk of COVID-19 exposure versus the risk of delay in diagnosis or therapy. In patients with known or suspected COVID-19 and ischemic heart disease, the balance of staff exposure and patient benefit will need to be weighed carefully.

Aim of the Work

Analyzing and assessing the impact of COVID 19 pandemic on the: (1) volume, type of patients and the different procedures performed. (2) The changes in management trends of cardiologists in the cath labs all over Egypt especially in the setting of acute coronary syndrome (ACS).

Methodology

An observational, multicenter and cross-sectional study will be conducted all over Egypt governorates using an online questionnaire about the changes in management trends in Cath labs and also safety practice attended by cardiologists during COVID-19 pandemic. This study will include residents, specialists and consultant cardiologists working at different cath lab units all over Egypt governorates.

Ethical considerations were followed according to the Declaration of Helsinki.

Results

This study has surveyed 30 cath labs distributed all over Egypt during COVID-19 pandemic with 43.35% located in urban area and 56.7% in rural areas. Majority of cath labs were university centers 43.3% while 36.7% and 20% were either governmental or private centers respectively. The Average number of cath lab(s) at surveyed centers was mostly 2 or more cath labs 76.7% with only 23.3% had one cath lab. Regarding average monthly case volume, most surveyed centers (83.3%) had more than 100 cases per month. Only 63.3% of surveyed centers were well-equipped to deal with COVID-19 active patients with the majority of them 60% using only surgical mask and face shield in patients not suspected to have COVID-19. At the same time, full personal protective equipment (PPE) was worn in only 6.7% of patients (Table 1, Fig 1).

There was a decrease in volume of new ACS patients in 80% of centers (Fig 2) and decrease in recurrent events in previously known stable IHD or previous percutaneous coronary intervention (PCI) patients received in 66.7% of centers. At the same time, the volume of ST-elevation myocardial infarction (STEMI) patients was decreased in 83.3% of surveyed centers (Fig 3) and the volume of primary PCI was decreased in 80% of centers (Fig 4). Regarding the delay in the invasive management for patients with ACS due to diagnostic testing and the ability to make more informed decision regarding infection control, there was 100% delay in all surveyed centers with 70% of centers suffering from delay in primary

TABLE 1. General characteristics of surveyed centers

		No.	Percent (%)
Geographical area	Urban	13	43.3
	Rural	17	56.7
Center type	Governmental	11	36.7
	University	13	43.3
	Private	6	20.0
Average number of cath lab (s) at surveyed centers	One	7	23.3
	Two	12	40.0
	Three	4	13.3
	More	7	23.3
Average monthly case volume	Less than 50	1	3.3
	From 50 to 100	4	13.3
	More than 100	25	83.3
Is the surveyed center well equipped to deal with COVID-19 active patients?	No	2	6.7
	To some extent	9	30.0
	Yes	19	63.3
Type of used PPE In patients suspected to have COVID-19	Full PPE	12	40.0
	Only surgical mask and face shield	18	60.0
Do all patients enter the cathlab with:	Full PPE	2	6.7
	Regular protection	28	93.3

PCI due to awaited testing (eg, X-ray chest, CT chest, complete blood count (CBC),. . .etc.). Additionally, 405 of surveyed centers had more than 24 hours delay in PCI in UA and non−ST-elevation myocardial infarction (NSTEMI) due to awaited testing (eg, X-ray chest, CT chest, CBC,. . .etc) (Fig 5). On the other hand, there was a decrease in the volume of patients receiving elective procedures in 83.3% of cath labs with a significant reduction in Percentage of noncoronary procedures done before and during COVID-19 pandemic with 23.3% of cath labs planning to stop practice temporarily (Table 2, Figs 6 and 7).

The management trends at surveyed centers during were significantly impacted during COVID-19 pandemic in this study. There was an increase in 90% of cath labs in the volume of patients with STEMI that received thrombolysis instead of primary percutaneous imaging (PPCI). Additionally, there was an increase in 96.7% of cath labs in volume of

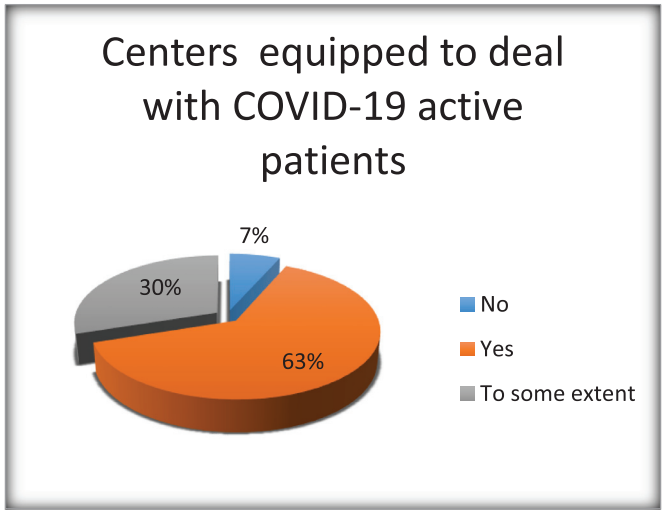

FIG 1. Centers equipped to deal with COVID-19 active patients.

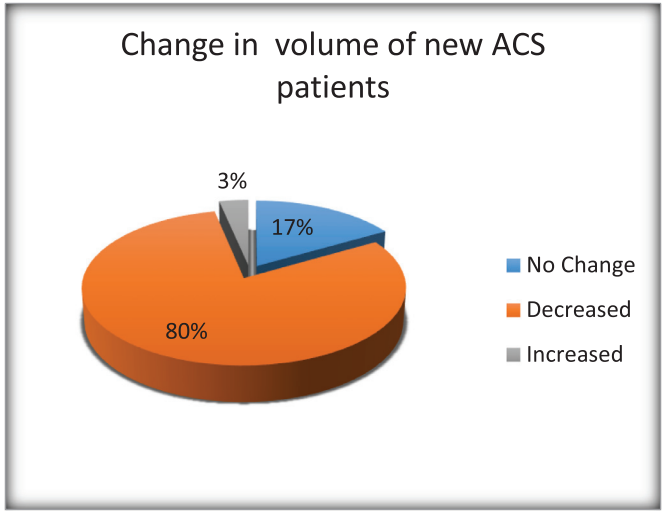

FIG 2. Change in volume of new ACS patients.

patients with unstable angina and non-ST segment elevation myocardial infarction (NSTEMI) that received only conservative strategy (Figs 8 and 9). Oppositely, there was a decrease in number of cases that had COVID-19 and STEMI and received primary PCI that reached 1-10 cases in 605 of surveyed centers. Along with 90% of cath labs have preferred to cancel

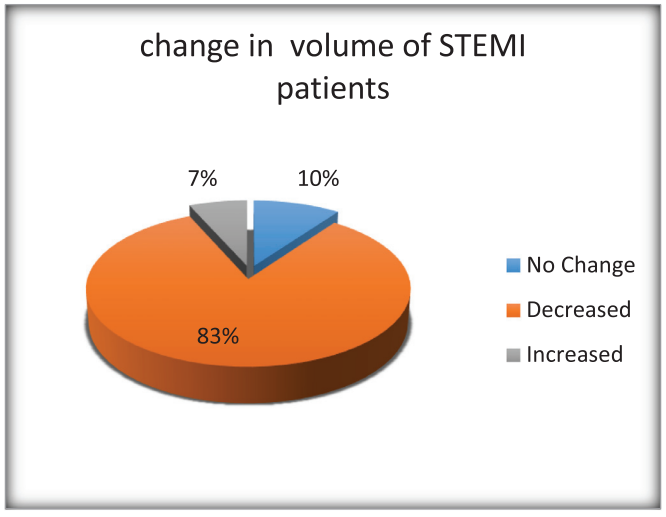

FIG 3. Change in volume of STEMI patients.

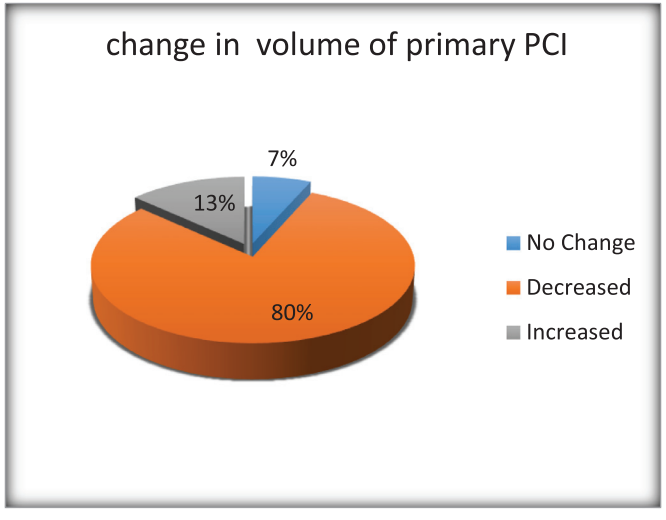

FIG. 4. Change in volume of primary PCI.

PCI and manage conservatively cases of COVID 19 with non−life-threatening conditions (Fig 10). Additionally, the majority of cath labs 63.3% had less than 20% of patients requiring more than 3 days in ACS setting (Table 3).

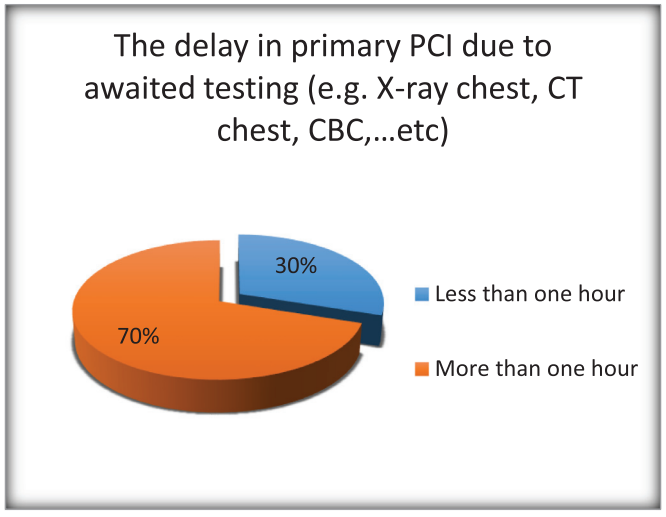

FIG 5. Delay in primary PCI.

The comparison of management trends at surveyed centers in relation to number of Cathlab(s) showed that the greater significant reduction in volume of new ACS patients was much observed in centers that have 2 and 3 or more cath labs (91.7% and 90.9%, respectively) compared to 42.9% in centers that have one cath labs (*P* value = 0.007). On the other hand, the number of cases had COVID-19 and STEMI who received thrombolysis was significantly lower in centers with three or more cath labs 9.1% compared to centers that have 1 or 2 cath labs (57.1% and 58.3% respectively) (*P* value = 0.006). Additionally, Average cases with COVID-19 and STEMI who received PPCI was significantly much greater in centers with 3 or more cath labs 27.3% compared to 0% in centers that have 1 or 2 cath labs (*P* value = 0.046). The routine use of CT chest before intervention was significantly higher in centers with three or more cathlabs 81.8% compared to centers that have one or two cathlabs (28.6% and 58.3% respectively) (*P* value = 0. 037) (Table 4, Fig 11).

The type of Cathlab significantly impacted the management trends at surveyed centers as there was a significant reduction in the volume of new ACS patients in Governmental and University centers (100% and 84.6%, respectively) compared to only 33.3% in private centers (*P* value = 0.003). Also The delay in PCI in UA and NSTEMI due to awaited testing (eg, X-ray chest, CT chest, CBC,. . .etc) was significantly more than 24 hours in Governmental and University centers (63.6% and 38.5% respectively) compared to only 0% in private centers (*P* value = 0.042).

TABLE 2. Burden of COVID-19 pandemic at surveyed centers

		No.	Percent (%)
Change in volume of new ACS patients	No Change	5	16.7
	Decreased	24	80.0
	Increased	1	3.3
Change in volume of recurrent events in previously known stable IHD or previous PCI patients	No Change	4	13.3
	Decreased	20	66.7
	Increased	6	20.0
Change in volume of STEMI patients	No Change	3	10.0
	Decreased	25	83.3
	Increased	2	6.7
Change in volume of primary PCI	No Change	2	6.7
	Decreased	24	80.0
	Increased	4	13.3
The delay in the invasive management for patients with ACS due to diagnostic testing and the ability to make more informed decision regarding infection control	Yes	30	100.0
The delay in primary PCI due to awaited testing (eg, X-ray chest, CT chest, CBC,. . .etc)	Less than one hour	9	30.0
	More than one hour	21	70.0
The delay in PCI in UA and NSTEMI due to awaited testing (eg, X-ray chest, CT chest, CBC,. . .etc)	Less than 24 hours	18	60.0
	More than 24 hours	12	40.0
change in volume of patients receiving elective procedures in the cathlab	No Change	1	3.3
	Decreased	25	83.3
	Increased	4	13.3
In your center; do you use routine CT chest before intervention?	No	12	40.0
	Yes	18	60.0
Percentage of noncoronary procedures done at your cathlab before COVID-19 pandemic	Less than 30%	22	73.3
	31-50%	5	16.7
	More than 50%	3	10.0
Percentage of noncoronary procedures done at your cath lab during COVID-19 pandemic	Less than 30%	28	93.3
	31%-50%	2	6.7
Planning to stop practice temporarily	No	23	76.7
	Yes	7	23.3

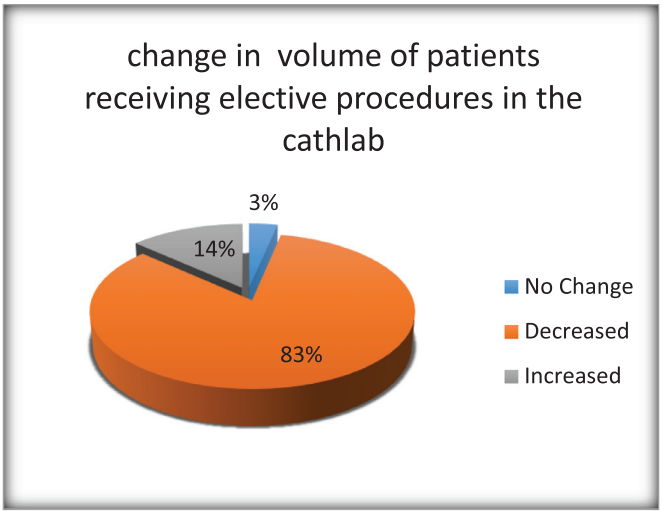

FIG 6. Change in volume of patients receiving elective procedures in the cathlab.

FIG 7. Planning to stop practice temporarily.

Additionally, the Average cases with COVID-19 and STEMI who received PPCI was much reduced in Governmental and University centers (100% and 38.5%, respectively) compared to only 33.3% in private centers (P value = 0.006). The routine use of CT chest before intervention was significantly noticed to be higher in Governmental and University

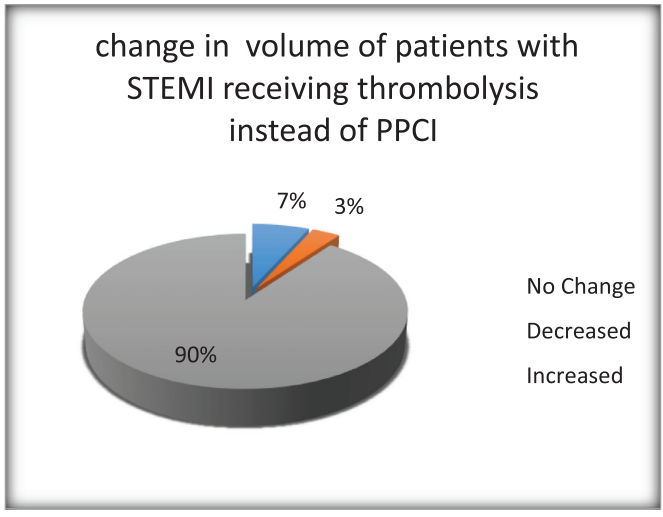

FIG 8. Change in volume of patients with STEMI receiving thrombolysis instead of PPCI.

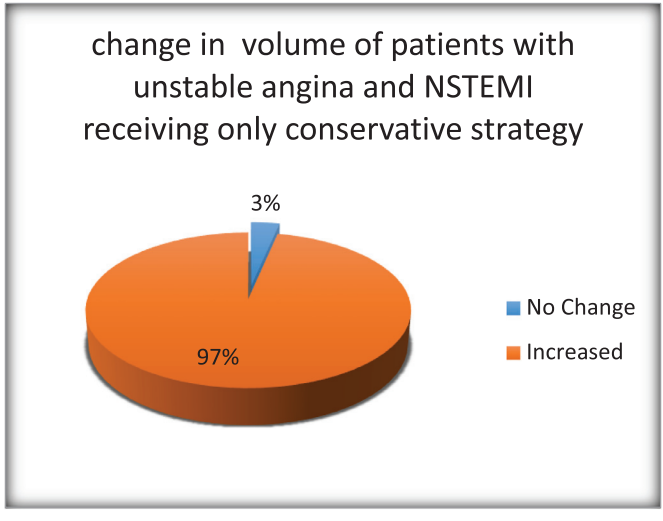

FIG 9. Change in volume of patients with unstable angina and NSTEMI receiving only conservative strategy.

centers (81.8% and 69.2%, respectively) compared to 0 % in private centers (*P* value = 0. 003). (Table 5, Fig 12).

The center equipment to deal with COVID-19 active patient had an additional impact on management trends at surveyed centers as the study showed a significantly 100% increase in volume of patients with unstable

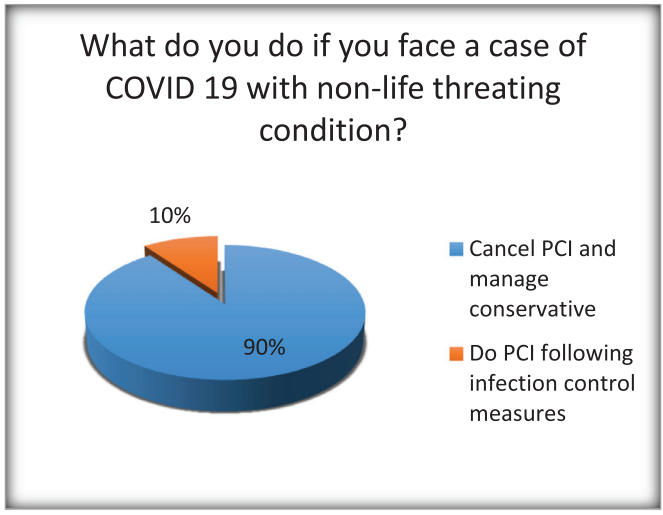

FIG 10. What do you do if you face a case of COVID 19 with non–life-threating condition?

angina and NSTEMI who received only conservative strategy in centers either equipped or to some extent equipped compared to 50% increase in nonequipped centers (*P* value = 0.047) (Fig 13). Also 94.7% and 100% of equipped and to some extent equipped centers respectively were preferred to cancel Management of cases of COVID 19 with non–life-threatening conditions and manage conservatively compared to 0% in nonequipped centers (*P* value = 0.007) (Table 6).

Regarding the PPE usage there was a significant increase in Average cases with COVID-19 and STEMI who received PPCI (more than 30 cases) in cath labs in which full PPE was used (25%) compared to 0% increase in cath labs in which only surgical mask and face shield were used (*P* value = 0.017) (Table 7).

Routine use of CT chest before intervention at surveyed centers in relation to geographical area showed a significant increase in the routing use of CT in urban centers 84.6% compared to 41.2% in rural centers (*P* value = 0.026) (Table 8).

Discussion

This study surveyed 30 cath labs distributed all over Egypt during COVID-19 pandemic. The burden of COVID-19 pandemic at surveyed centers was analyzed at the current study. A decrease in the volume of new ACS patients during the pandemic was noted in 80% of surveyed

TABLE 3. Change of management trends at surveyed centers during COVID-19 pandemic

		No.	Percent (%)
Change in volume of patients with STEMI receiving thrombolysis instead of PPCI	No change	2	6.7
	Decreased	1	3.3
	Increased	27	90.0
Change in volume of patients with unstable angina and NSTEMI receiving only conservative strategy	No change	1	3.3
	Increased	29	96.7
Number of cases with COVID-19 and STEMI who received thrombolysis	1-10 cases	12	40.0
	11-20 cases	6	20.0
	21-30 cases	6	20.0
	More than 30 cases	6	20.0
Number of cases had COVID-19 and STEMI who received PPCI	1-10 cases	18	60.0
	11-20 cases	7	23.3
	21-30 cases	2	6.7
	More than 30 cases	3	10.0
Management of cases of COVID 19 with non–life-threatening conditions	Cancel PCI and manage conservative	27	90.0
	Do PCI following infection control measures	3	10.0
Percentage of patients requiring more than 3 days in ACS setting	Less than 20%	19	63.3
	21-50%	9	30.0
	More than 51%	2	6.7

centers parallel to a decrease in recurrent events in previously known stable IHD or previous PCI patients received in 66.7% of centers.

The volume of STEMI patients was decreased in 83.3% of surveyed centers, the same as the volume of primary PCI was found to be decreased in 80% of centers.

This was concordant with Indolfi et al who published a multicenter observational survey from Italy examining consecutive patients admitted with acute myocardial infarction (AMI) during the week of 12-19 March

TABL 4. Comparison of management trends at surveyed centers in relation to number of Cath lab(s)

		Number of cath lab(s) at your center				*P* value
		One	Two	Three or more		
Change in volume of new ACS patients	No change	N.	4	1	0	0.007
		%	57.1%	8.3%	0.0%	
	Decreased	N.	3	11	10	
		%	42.9%	91.7%	90.9%	
	Increased	N.	0	0	1	
		%	0.0%	0.0%	9.1%	
Average cases with COVID-19 and STEMI who received thrombolysis	1-10 cases	N.	4	7	1	0.006
		%	57.1%	58.3%	9.1%	
	11-20 cases	N.	1	3	2	
		%	14.3%	25.0%	18.2%	
	21-30 cases	N.	2	1	3	
		%	28.6%	8.3%	27.3%	
	More than 30 cases	N.	0	1	5	
		%	0.0%	8.3%	45.5%	
Average cases with COVID-19 and STEMI who received PPCI	1-10 cases	N.	4	10	4	0.046
		%	57.1%	83.3%	36.4%	
	11-20 cases	N.	3	1	3	
		%	42.9%	8.3%	27.3%	
	21-30 cases	N.	0	1	1	
		%	0.0%	8.3%	9.1%	
	More than 30 cases	N.	0	0	3	
		%	0.0%	0.0%	27.3%	
Routine use of CT chest before intervention	No	N.	5	5	2	0.037
		%	71.4%	41.7%	18.2%	
	Yes	N.	2	7	9	
		%	28.6%	58.3%	81.8%	

2020 at the height of the COVID-19 outbreak in Italy, compared with the same time period in 2019. A total of 618 AMIs were recorded during the 1-week period in 2019, compared with 319 in 2020, with a 48.4% reduction. There was a 26.5% decrease in STEMI admissions and a 65.4% decrease in NSTEMI admissions[6] also Garcia S et al,[7] have suggested a

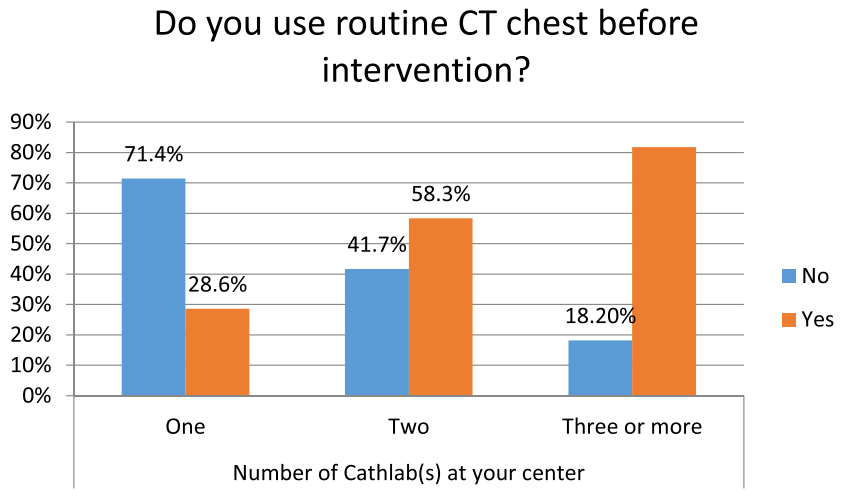

FIG 11. Routine CT chest before intervention.

decrease in the number of patients presenting to hospitals because of emergency conditions such as AMI.

This decline might be attributed to patients' fear of being infected by SARS-CoV-2 in case of hospitalization, resulting in a delayed first medical contact. On the other hand causes can be searched into health care system reorganization, this resulted in concentration of a vast majority of patients with AMI in a limited number of hospitals.

PPCI remains the standard of care for patients with STEMI during the COVID-19 pandemic, according to a consensus statement published online April 20 in the Journal of the American College of Cardiology. Delayed reperfusion results in larger myocardial infarct size, increased risk for heart failure and shock .In the current survey, we confirmed a time delay in the invasive management for patients with ACS due to diagnostic testing and the ability to make more informed decision regarding infection control, with 70% of centers suffering a delay in primary PCI due to awaited testing (eg, X-ray chest, CT chest, CBC,. . .etc.). Researchers also found that the COVID-19 outbreak delayed primary PCI for about 21 minutes in Hubei province and about four minutes in other provinces.[8] Indolfi et al also recorded a 39.2% increase in time from symptom onset to coronary angiography, and 31.5% increase in the time from first medical contact to coronary revascularization.

A survey of 43 UK primary PCI centers was performed and a significant reduction in the number of open cath labs was found (pre-COVID 3.6 ± 1.8 vs post-COVID 2.1 ± 0.8; $P < 0.001$) with only 64% of cath

TABLE 5. Comparison of management trends at surveyed centers in relation to center type

			Center Type			*P* value
			Governmental	University	Private	
Change in volume of new ACS patients	No change	N.	0	1	4	0.003
		%	0.0%	7.7%	66.7%	
	Decreased	N.	11	11	2	
		%	100.0%	84.6%	33.3%	
	Increased	N.	0	1	0	
		%	0.0%	7.7%	0.0%	
The delay in PCI in UA and NSTEMI due to awaited testing (e.g. X-ray chest, CT chest, CBC,. . .etc)	Less than 24 hours	N.	4	8	6	0.042
		%	36.4%	61.5%	100.0%	
	More than 24 hours	N.	7	5	0	
		%	63.6%	38.5%	0.0%	
Average cases with COVID-19 and STEMI who received PPCI	1-10 cases	N.	11	5	2	0.006
		%	100.0%	38.5%	33.3%	
	11-20 cases	N.	0	4	3	
		%	0.0%	30.8%	50.0%	
	21-30 cases	N.	0	1	1	
		%	0.0%	7.7%	16.7%	
	More than 30 cases	N.	0	3	0	
		%	0.0%	23.1%	0.0%	
Routine use of CT chest before intervention	No	N.	2	4	6	0.003
		%	18.2%	30.8%	100.0%	
	Yes	N.	9	9	0	
		%	81.8%	69.2%	0.0%	

labs remained open during the COVID-19 pandemic.[9] In our survey, there was a decrease in the volume of patients receiving elective procedures in 83.3% of cath labs with a significant reduction in percentage of noncoronary procedures done before and during COVID-19 pandemic, with 23.3% of cath labs were planning to stop practice temporarily. The reduction in the number of open cardiac cath labs is likely due to cessation of elective work, although there may be other reasons including reduction in staffing (ie, due to sickness or social isolation policies) and/

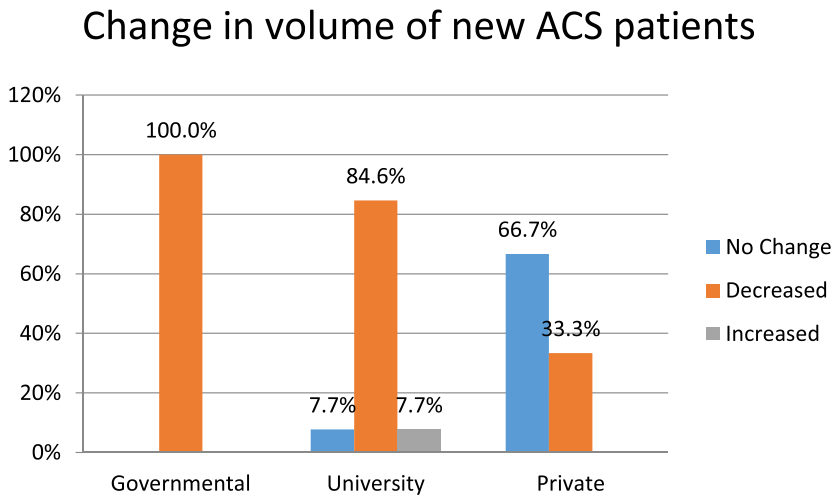

FIG 12. Change in volume of new ACS patients according to type of hospital.

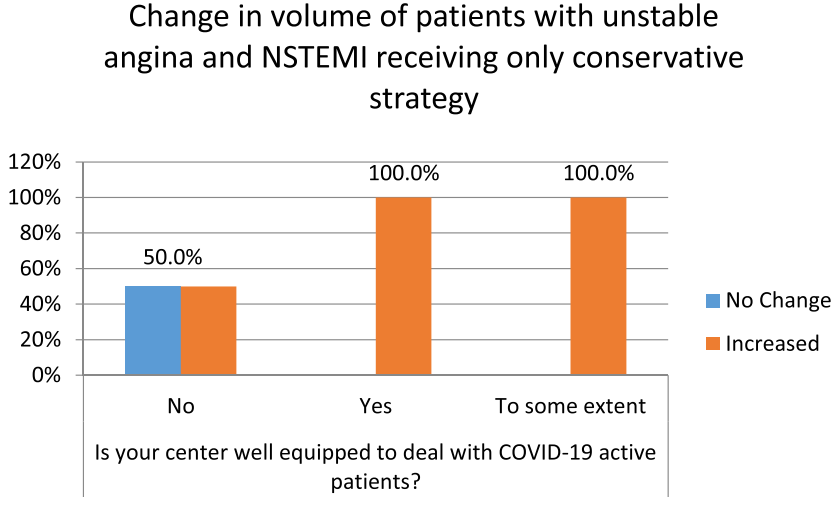

FIG 13. Change in volume of patients with unstable angina and NSTEMI receiving only conservative strategy according to center capabilities to deal with COVID-19 active patients.

or reductions in hospital attendances.[10] This is similar to a study from Spain, a telematics survey of 81 centers involved within a STEMI network equipped with cardiac cath labs showed a dramatic decline in procedural volumes during a 10-day period during the peak of the COVID-19 pandemic. Data obtained from 71 centers over a 7-day period before the

TABLE 6. Comparison of management trends at surveyed centers in relation to center equipment to deal with COVID-19 active patient

		Is your center well equipped to deal with COVID-19 active patients?			*P* value
		No	**Yes**	**To some extent**	
Change in volume of patients with unstable angina and NSTEMI receiving only conservative strategy	No change	N.	1	0	0	0.047
		%	50.0%	0.0%	0.0%	
	Increased	N.	1	19	9	
		%	50.0%	100.0%	100.0%	
Management of cases of COVID 19 with non-life threatening conditions	Cancel PCI and manage conservative	N.	0	18	9	0.007
		%	0.0%	94.7%	100.0%	
	Do PCI following infection control measures	N.	2	1	0	
		%	100.0%	5.3%	0.0%	

TABLE 7. Comparison of management trends at surveyed centers in relation to PPE usage

			In patients nonsuspected to have COVID-19; what type of PPE you use?		*P* value*
			Full PPE	Only surgical mask and face shield	
Average cases with COVID-19 and STEMI who received PPCI	1-10 cases	N.	5	13	0.017
		%	41.7%	72.2%	
	11-20 cases	N.	3	4	
		%	25.0%	22.2%	
	21-30 cases	N.	1	1	
		%	8.3%	5.6%	
	More than 30 cases	N.	3	0	
		%	25.0%	0.0%	

*Fischer Exact test.

TABLE 8. Comparison of management trends at surveyed centers in relation to geographical area

			Geographical area		*P* value*
			Urban	Rural	
Routine use of CT chest before intervention	No	N.	2	10	0.026
		%	15.4%	58.8%	
	Yes	N.	11	7	
		%	84.6%	41.2%	

*Fischer Exact test.

start of the pandemic and during the pandemic revealed a 57% decline in diagnostic procedures, a 48% decline in PCI, an 81% decline in structural procedures, and a 40% reduction in the cases of STEMI treated with PCI. Four centers reported increased use of thrombolytics in cases of suspected or confirmed COVID-19.[11]

The management trends in the current Egyptian survey were significantly impacted during COVID-19 pandemic, there was an increase in 90% of cath labs in the volume of patients with STEMI that received thrombolysis instead of PPCI. Additionally, there was an increase in 96.7% of cath labs in volume of patients with unstable angina and NSTEMI that received only

conservative strategy. Oppositely, there was a decrease in the number of cases that had COVID-19 and STEMI and received PPCI.

In the United States, an early analysis from 9 high-volume centers (>100 PCIs per year) to show if a decrease in PCI was observed in the United States during the pandemic. A mixed model analyzing data comparing before COVID-19 time (January 1, 2019 to February 29, 2020) with after COVID-19 (1-31 March 2020) showed a 38% decrease in STEMI cases. There was mean of 23.6 STEMI cases/month in the period before COVID-19 and 15.3 cases/month in period after COVID-19.[12]

The reasons for the decline in ACS patients remain unknown; however, there are a lot of theories. Some suggest that patients are staying at home and trying to treat symptoms themselves until the restrictions are cancelled. Others suggest that staying at home and social distancing may be resulting in decreasing exertional activity which triggers cardiac symptoms. Indolfi et al suggested that low physical stress and increase of resting state during the quarantine may be the cause. Also the patients fear of catching the virus in hospitals led to either late presentation or not going at all.[13] We look forward to further studies with more data that test some of the suggested theories.

Limitations

Only short period analysis of COVID 19 effect on cath labs service during pandemic could be surveyed in this research. It will be necessary to follow up the long time impact of the delay in diagnosis and treatment of those patients.

Impact on Daily Practice

Due to economic impact of COVID-19 and the media highlighted coronavirus over chronic diseases, cardiac patients especially those with ACS suffer less medical attention than should be. A focus on this defect may be helpful in standardizing a strategy for optimum patient's management and doctor's safety.

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For all in the front line we appreciate that you're risking your health to care for our community.

REFERENCES

1. Wu F, Zhao S, Bin Y, et al. A new coronavirus associated with human respiratory disease in China. *Nature* 2020;579:265–369.
2. World Health Organization. WHO | Novel Coronavirus – China (WHO), 2020.
3. Egypt announces first Coronavirus infection. *Egypt Today* 2020. Archived from the original on 15 February 2020. Retrieved 14 February 2020.
4. Beijing orders 14-day quarantine for all returnees. *BBC News* 2020. Archived from the original on 14 February 2020. Retrieved 14 February 2020.
5. Egypt's health ministry announces first confirmed coronavirus case. *France 24* 2020. Archived from the original on 16 February 2020. Retrieved 16 February 2020.
6. De Rosa S, Spaccarotella C, Basso C, et al. Reduction of hospitalizations for myocardial infarction in Italy in the COVID-19 era. *Eur Heart J* 2020;41:2083–8. [PMC free article] [PubMed] [Google Scholar].
7. Garcia S, Albaghdadi MS, Meraj PM, et al. Reduction in ST-segment elevation cardiac catheterization laboratory activations in the United States during COVID-19 pandemic. J Am Coll Cardiol.
8. Xiang D, Xiang X, Zhang W, et al. Management and outcomes of patients with STEMI during the COVID-19 pandemic in China. *J Am Coll Cardiol* 2020. https://doi.org/10.1016/j.jacc.2020.06.039.
9. Adlan AM, Lim VG, Dhillon G, et al. Gershan Davis Impact of COVID-19 on primary percutaneous coronary intervention centres in the UK: a survey June 2020. *Br J Cardiol* 2020;27:51–4. https://doi.org/10.5837/bjc.2020.017.
10. NHS England. A&E attendances and emergency admissions 2019-20. Published online 2020. https://www.england.nhs.uk/statistics/statistical-work-areas/ae-waiting-times-and-activity/ae-attendances-and-emergency-admissions-2019-20/ (last accessed 26th 2020).
11. Al-Quteimat OM, Amer AM. The impact of the COVID-19 pandemic on cancer patients. *Am J Clin Oncol* 2020. https://doi.org/10.1097/COC.0000000000000712. [PMC free article] [PubMed] [Google Scholar].
12. Garcia S, Albaghdadi MS, Meraj PM, et al. Reduction in ST-segment elevation cardiac catheterization laboratory activations in the United States during COVID-19 pandemic. *J Am Coll Cardiol* 2020. https://doi.org/10.1016/j.jacc.2020.04.011. [PMC free article] [PubMed] [Google Scholar].
13. Alraies MC, Raza S, Ryan J. Twitter as a new core competency for cardiologists. *Circulation* 2018;138:1287–9. [PubMed] [Google Scholar].