



Survey of coronary catheterization laboratory activity in Iran during the coronavirus disease-2019 pandemic

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Short Communication

Abstract

BACKGROUND: With the onset of the coronavirus disease-2019 (COVID-19) pandemic, hospitalization and treatment of non-covid patients decreased worldwide. The aim of this study is to evaluate the admission and treatment of patients with coronary artery diseases (CADs) by examining coronary Cath labs activities in some centers of Iran during the COVID-19 period.

METHODS: A retrospective, multi-center survey was conducted in four cities in Iran which participated in National Persian Registry Of CardioVascular disease (N-PROVE). Two periods of COVID-19 occurrence peak in Iran were compared with the same date in 2019. Information was collected on the number of diagnostic and therapeutic coronary catheterizations in both stable ischemic heart diseases (SIHDs) and acute coronary syndrome (ACS) settings.

RESULTS: In the first peak of COVID-19 pandemic, coronary angiographies and angioplasties decreased by 37 and 38% compared to the same period in 2019, respectively. The most common indication for coronary angiography during this period was ACS [especially ST-Segment Elevation Myocardial Infarction (STEMI)]; however, at the time of peak decrease, the SIHDs were the most. In the second peak of COVID-19 pandemic in Iran, 34% and 27% decrease in diagnostic and therapeutic coronary procedures were seen, respectively. During this period, the number of elective admissions increased, although it was still lower than that in 2019. The tendency to rescue percutaneous coronary intervention increased in most centers during the COVID-19 era, especially in the second peak.

CONCLUSION: A significant reduction in the coronary Cath lab activity has been observed during the COVID-19 pandemic that can indicate an increased risk of cardiovascular mortality and morbidity.

Keywords: Coronavirus Disease-2019; Coronary Angiography; Coronary Angioplasty; ST-Segment Elevation Myocardial Infarction; Survey

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Introduction

A severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) broke out in Wuhan, China and rapidly become a widespread outbreak named COVID-19 pandemic. This pandemic had a very significant impact on the function of the world's healthcare systems, reducing elective admissions and changing the management and treatment of emergency patients.¹⁻⁶ In fact, one of the major

challenges in this period is how to deal with non-COVID-19 patients. Cardiovascular diseases

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(CVDs), especially coronary artery diseases (CADs), including both of stable ischemic heart diseases (SIHD) and acute coronary syndromes (ACS) are examples of these patients. The turning point of these diseases is the activity of the Cath labs. Various reports have been published from different parts of the world on the Cath lab activity in COVID-19 era, which shows the importance of this issue. In this regards, we seek to provide data about the activities of several Cath labs in Iran in COVID-19 pandemic period and compare it with non-COVID-19 era.

Materials and Methods

Study design: A retrospective, multi-center survey was conducted in four cities in Iran which participated in the National Persian Registry Of CardioVascular disease (N-PROVE)⁷ which is a large-scale registry developed after local demonstration study in Isfahan named "Persian Registry of Cardiovascular Disease (PROVE).⁸ This survey was referred back to two periods of COVID-19 pandemic peak in Iran: the first peak between 5 March 2020 to 20 May 2020 and the second peak between 21 June 2020 to 21 August 2020. The same date in the past year ago (2019) was defined as the control period. All data were collected during the ten days from 22 August to 1 September from the abovementioned registry, coronary angiography, and angioplasty part. Because all data were anonymized, ethical approval was not required.

Our selected centers included Shahid Chamran Heart Center as the largest referral cardiovascular hospital in the center of Iran and Sina Heart Center and Askariyeh Hospital as private centers from Isfahan city, Shahid Mohammadi Hospital of Bandar Abbas City (South of Iran), Imam Khomeini Hospital of Ahvaz City (South-West of Iran), and Razi Hospital of Birjand in the east of Iran.

Variables: Our main objective was to obtain the quantity of diagnostic and therapeutic coronary procedures in the first and second COVID-19 peaks in Iran in comparison to pre-COVID-19 condition. In the first peak, we had sever quarantine rules for general population and health centers, whereas in the second period, the quarantine rules became more limited. Accordingly, the total number of coronary artery angiographies and angioplasties were primary variables and the medical indications of these procedures such as SIHD, ACS, and its subtypes like Unstable Angina (UA), Non-ST-Segment Elevation Myocardial Infarction (Non-STEMI), and STEMI were our secondary endpoints. The percentage of the STEMI treatment strategy including primary

percutaneous coronary intervention (PCI) and rescue PCI also were considered.

Statistical analysis: In this study, the total and weekly number of all diagnostic and therapeutic coronary procedures during pandemic and when the pandemic went down with negative and/or positive percent variation were reported.

Results

Information was extracted from 6 centers in four cities of Iran. Four centers were as governmental/university hospitals, one of which was a large referral and dedicated cardiovascular hospital (Shahid Chamran Heart Center). The other two centers were private hospitals. In general, in the first peak of the SARS-Cov-2 pandemic in Iran, 2149 diagnostic coronary angiographies were performed in the aforementioned centers, which showed a 37% decrease compared to the same period in 2019 (3415 cases). The detailed statistics of any center are presented in figure 1.

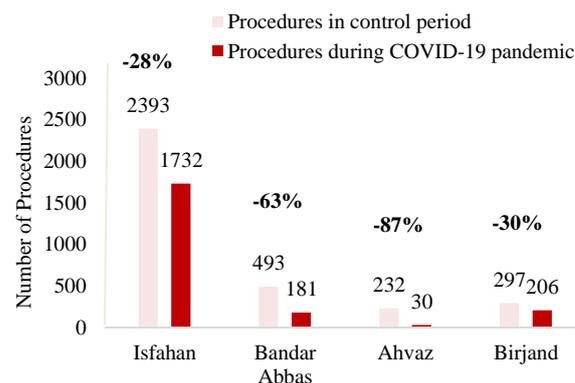


Figure 1. Variation in the number of diagnostic coronary procedures in the first coronavirus disease-2019 (COVID-19) peak

The most common indication for coronary angiography during this period was patients with ACS, with STEMI being the most common; while, in the previous year, SIHD (especially in Shahid Chamran Heart Center and Isfahan Province) was the most common cause of diagnostic angiography. In the year before the outbreak of the COVID-19 pandemic, UA was the most common need for angiography among ACS subjects.

In the second peak of prevalence of the SARS-Cov-2 infection in Iran, which was associated with fewer limitations than the first peak; again a 34% decrease in coronary angiography cases was recorded in the above centers (Figure 2). Meanwhile, some centers, such as Imam Khomeini

Hospital in Ahvaz, did not accept any patients due to the very high prevalence of COVID-19 in this region (red condition). During this period, the number of SIHDs compared to ACS cases in Isfahan Province centers was increased, although in comparison to 2019, the number of SIHD cases had decreased and, like Razi Hospital, the STEMI subjects had increased (Table 1).

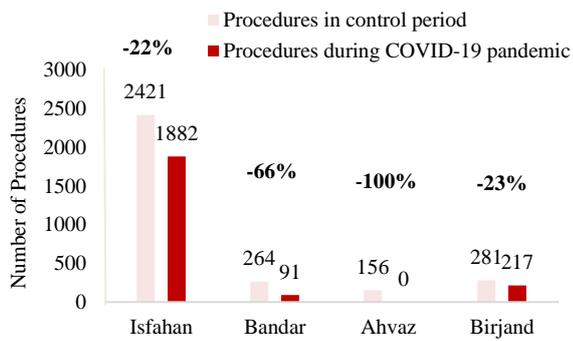


Figure 2. Variation in the number of diagnostic coronary procedures in the second coronavirus disease-2019 (COVID-19) peak

In comparison to the same period in 2019, the total number of coronary angioplasties in the first and second peaks of the COVID-19 pandemic decreased by 38% and 27%, respectively. In general, during the COVID-19 pandemic, most PCIs were performed in patients with STEMI and the tendency to rescue PCI increased in most centers during the COVID-19 era, especially in the second peak (Table 2).

Discussion

The results of this study showed that the total number of coronary angiographies and angioplasties in both COVID-19 peak periods in Iran compared to the same period in the previous year decreased by approximately 30 to 40%. The patients' hospitalization indication for the coronary procedures also changed and the rate of ACS cases increased, in addition to the decreased SIHD cases.

In the first peak of the COVID-19 outbreak in Iran, severe social restrictions such as home quarantine were imposed on most cities in Iran, especially Isfahan and Ahvaz. The health systems were also restricted or banned from performing elective procedures. These items, along with patients' fear of referring to medical centers, were important reasons for the decrease in the admission of patients with CADs. In the second outbreak, social restrictions were eased by the government

and the Ministry of Health and social distance protocols were defined for public places. During this period, the restrictions on the elective practices like coronary angiography and angioplasty procedures were also lifted.

However, the number of hospitalizations was lower than the same period in the last year, which could be due to the reluctance of physicians and medical staff to perform elective procedures, continued patients' fear of referring to medical centers, and financial incapacity due to economic problems. In general, during the COVID-19 pandemic, physicians had more tendency to take emergency procedures rather than electives. However, this tendency was more observed in smaller centers and non-specialized cardiovascular hospitals in this survey.

The tendency to hospitalization of ACS cases to performing diagnostic and therapeutic coronary procedures was seen in all our centers at both corona virus pandemic peaks in Iran. This trend was more pronounced in smaller cities and non-referral centers.

According to the initial definition of the standard treatment of STEMI, which was based on lytic therapy, the number of rescue PCI increased during the COVID-19 period.⁹ Today, however, the choice treatment of STEMI as before the COVID-19 pandemic is the primary PCI.¹⁰⁻¹¹ In this survey, we observed an overall increase in rescue PCI; however, in the only referral center of this study, the primary PCI approach was still more than the rescue PCI.

Daoulah et al. demonstrated a significant decrease (28%) in STEMI volume from 16 hospitals in 5 provinces in Kingdom of Saudi Arabia during the COVID-19 pandemic in comparison to the pre-COVID-19 era in 2018 and 2019.¹ In a large multicenter study (73 centers in Spain) a 56% decrease in the number of diagnostic coronary procedures and 48% decrease in PCIs were observed. PCI in patients with STEMI also decreased by 40% in COVID-19 pandemic period.² These results were also seen in further studies in other European centers.^{5,12} A survey of 43 primary PCI centers across the United Kingdom that was conducted between 15 to 22 April 2020, indicated 64% of Cath labs remaining open during the COVID-19 crisis. However, based on the British Cardiovascular Society (BCS), the British Cardiovascular Intervention Society (BCIS), and the British Heart Rhythm Society (BHRS) guidelines, the primary PCI should remain as a choice of treatment of acute STEMI.³

Table 1. Variation in the number of diagnostic coronary procedures based on indications in the first and second coronavirus disease-2019 (COVID-19) peaks

Variables	First COVID-19 peak			Second COVID-19 peak		
	Diagnostic procedures during COVID-19 pandemic (n= 1982)	Diagnostic procedures in control period (n = 3100)	Variation (%)	Diagnostic procedures during COVID-19 pandemic (n = 2087)	Diagnostic procedures in control period (n = 3193)	Variation (%)
Isfahan (weekly)	1625 (162)	2150 (270)	-24.0	1825 (182)	2325 (291)	-21.0
SIHD	303	1359	-78.0	999	1564	-36.0
ACS	1322	791	+40.0	826	761	+8.0
UA	389	392	-0.8	326	353	-8.0
NSTEMI	333	208	+38.0	189	147	+22.0
STEMI	600	191	+68.0	311	261	+16.0
Bandar Abbas (weekly)	169 (17)	480 (60)	-65.0	89 (9)	449 (56)	-80.0
SIHD	19	96	-80.0	6	124	-95.0
ACS	150	384	-61.0	83	325	-74.0
UA	70	165	-58.0	36	177	-80.0
NSTEMI	27	98	-72.0	18	74	-76.0
STEMI	53	121	-56.0	29	74	-61.0
Ahvaz (weekly)	14 (1)	220 (27)	-94.0	0	148 (18)	-100.0
SIHD	5	70	-93.0	0	33	-100.0
ACS	9	150	-94.0	0	115	-100.0
UA	3	97	-97.0	0	78	-100.0
NSTEMI	0	19	-100.0	0	16	-100.0
STEMI	6	34	-82.0	0	21	-100.0
Birjand (weekly)	174 (17)	250 (31)	-30.0	173 (17)	271 (34)	-36.0
SIHD	19	64	-70.0	36	71	-49.0
ACS	155	186	-17.0	137	200	-31.0
UA	38	79	-52.0	49	112	-56.0
NSTEMI	30	41	-27.0	31	48	-35.0
STEMI	87	66	+24.0	57	40	+30.0

COVID-19: Coronavirus disease-2019; SIHD: Stable ischemic heart disease; ACS: Acute coronary syndrome; UA: Unstable angina; NSTEMI: Non-ST elevation myocardial infarction; STEMI: ST-elevation myocardial infarction;

Table 2. Variation in the number of therapeutic coronary procedures based on indications in the first and second coronavirus disease-2019 (COVID-19) peaks

Variables	First COVID-19 peak			Second COVID-19 peak		
	Therapeutic procedures during COVID-19 pandemic (n= 982)	Therapeutic procedures in control period (n = 1589)	Variation (%)	Therapeutic procedures during COVID-19 pandemic (n = 1123)	Therapeutic procedures in control period (n = 1550)	Variation (%)
Isfahan (weekly)	778 (78)	1164 (145)	-33.0	971 (97)	1266 (158)	-23.0
SIHD	143	544	-74.0	399	691	-42.0
UA	272	328	-17.0	162	235	-31.0
NSTEMI	59	103	-43.0	108	111	-3.0
STEMI	304	189	+38.0	302	229	+24.0
Primary PCI	219	131	+40.0	172	194	-11.0
Rescue PCI	85	58	+32.0	130	35	+73.0
Bandar Abbas (weekly)	87 (9)	222 (28)	-61.0	48 (5)	185 (23)	-74.0
SIHD	7	33	-79.0	2	40	-95.0
UA	27	55	-51.0	18	66	-73.0
NSTEMI	11	50	-80.0	7	30	-77.0
STEMI	42	84	-50.0	21	49	-57.0
Primary PCI	9	47	-81.0	6	29	-79.0
Rescue PCI	33	37	-11.0	15	20	-25.0
Ahvaz (weekly)	5 (1)	72 (9)	-93.0	0	26 (3)	-100.0
SIHD	1	19	-95.0	0	4	-100.0
UA	1	20	-95.0	0	13	-100.0
NSTEMI	0	11	-100.0	0	2	-100.0
STEMI	3	22	-86.0	0	7	-100.0
Primary PCI	0	11	-100.0	0	5	-100.0
Rescue PCI	3	11	-73.0	0	2	-100.0
Birjand (weekly)	112 (11)	131 (16)	-14.0	104 (10)	73 (9)	+30.0
SIHD	6	27	-78.0	9	14	-36.0
UA	13	33	-61.0	14	15	-7.0
NSTEMI	16	25	-36.0	13	19	-32.0
STEMI	77	46	+40.0	68	25	+63.0
Primary PCI	32	26	+19.0	31	15	+52.0
Rescue PCI	45	20	+55.0	37	10	+73.0

COVID-19: Coronavirus disease-2019; SIHD: Stable ischemic heart disease; UA: Unstable angina; NSTEMI: Non-ST elevation myocardial infarction; STEMI: ST-elevation myocardial infarction; PCI: Percutaneous coronary intervention

The Latin America health care activity with the evaluation of 79 centers in 20 countries also showed significant decrease in the number of diagnostic procedures (65.2%), coronary interventions (59.4%), and STEMI care (51.2%).⁶

In our assessment, the number of STEMI cases in our referral centers and hospitals that were active during the COVID-19 pandemic increased; as these centers were responsible for admitting patients in their area when other centers were inactive. The tendency to prescribe fibrinolytics was generally increased in both stages of COVID-19 in Iran. In line with the results of our study, Elliott et al. showed that the acute PCI procedures to treat STEMI did not decrease during the Level 4 lockdown for COVID-19 in New Zealand. Their justification was the difference in the activities and approach of hospitals in COVID-19 pandemic. However, they demonstrated that in-patient coronary angiographies and PCIs fell by more than 50%.⁴

Finally, it must be noted that the COVID-19 pandemic should not affect the standard treatment of emergency patients. Most of the Cath lab activity reduction has been due to the direct involvement of most centers in the treatment of the patients with SARS-Cov-2 in the early stages of the pandemic.

This report highlights several points and challenges facing health system management. First, at the beginning of the COVID-19 pandemic, the main factor preventing elective procedures was the rules and restrictions of the insurances and government. Then in the continuation of the pandemic and in the second peak, the decision of the hospitals, medical staff, and patients was determining in this regard. Second, due to the decrease in the elective procedures during the pandemic era, correct and accurate decisions and diagnoses and differentiation of the SIHD and ACS conditions by physicians and medical centers are required. Third, in both the first and second COVID-19 peaks, referral centers had a higher level of activity, which highlighted the need for more planning in the field of personnel protection and stronger provision of prevention and treatment facilities for these centers. The closure of some small and private centers during the pandemic crisis is also confirms this issue. Fourth, the pandemic conditions in each region and the volume of its patients determine the treatment approach of the referral centers. However, any therapeutic approach, contrary to scientific guidelines, should be considered in the health system of the area.

Conclusion

Significant reduction in the coronary Cath lab activity in both diagnostic and therapeutic procedures has been observed during the COVID-19 pandemic. Cath lab admission pattern has also been changed as the increase in ACS and decrease in SIHD patients.

Limitations: The survey was of a selection bias, as it was extracted from limited centers that participated in PCVDR and the information of many large referral hospitals in Iran was not available in this study.

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Conflict of Interests

Authors have no conflict of interests.

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