

Coronavirus Pandemic

The effects of the COVID-19 lockdown on patients with chronic cardiovascular disease in Vietnam

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Abstract

Introduction: We evaluated the impact of the lockdown policy during the COVID-19 pandemic on cardiovascular outpatients of a cardiology clinic in Vietnam from April to June 2020. We estimated the occurrence of different cardiovascular problems in general and the stability of blood pressure.

Methodology: During the Covid-19 outbreak in Vietnam, we conducted a cross-sectional study to evaluate its impact on blood pressure stability of hypertensive patients treated as outpatients at the clinic of the University Medical Center (UMC), Ho Chi Minh City.

Results: The mean age of the recruited 493 patients was 62.2 ± 10.2 years. The stable blood pressure group consisted of 87% patients, while the unstable blood pressure group consisted of 13% patients. We found that 68% of the study population attended their follow-up appointments as scheduled: 87% with stable blood pressure versus only 13% with unstable blood pressure. Significant differences were noticed in body weight changes and cardiovascular problems between the two groups: body weight increase (22.6% vs. 10.2%), body weight decrease (3.2% vs. 6.7%), worsening of cardiovascular problems (35.5% vs. 17.9%) in the unstable and stable blood pressure groups, respectively. Multivariable regression analysis reflected the impact of the increase in body weight and occurrence of cardiovascular problems on the patients with unstable blood pressure.

Conclusions: Our study provided concrete proof of the impact of the lockdown on chronic patients, which should warrant further surveys, and evaluation of the lockdown policy.

Key words: Lockdown; COVID-19; cardiovascular disease; outpatient.

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Introduction

The World Health Organization (WHO) announced a name for the new coronavirus disease, COVID-19 (coronavirus disease 2019), on 11 February 2020. Since then, the COVID-19 epidemic has spread rapidly among nations, which has contributed to high morbidity and mortality rate around the world. By March 2020, WHO declared COVID-19 a global pandemic [1]. To limit the spread of COVID-19, many countries around the world, including Vietnam, adopted a strict policy to control or limit spread of the virus, including

restrictions on outdoor activities and avoiding large crowds.

These implemented containment measures have proven their efficacy in hampering the progression of the pandemic as suggested by the flattening of the number of cases [2]. One of the most stringent measures was the lockdown, restricting entire societies and requiring people to remain at home and only leave for limited essential needs, and it seemed to be a perfect countermeasure against COVID19 [3]. Lockdown is often regarded as an unpleasant experience involving loss of freedom, uncertainty over disease status, and

limited access to social health services, all of which can lead to dramatic consequences. This policy was and is still a debatable subject raising concern [4]. Despite its efficacy, many issues were arising such as anxiety, depression, and sleep disorders [5]. Other concerning aspects were the limited access to chronic treatments and the lack of follow up of chronic patients [6]. Among the affected patients are the cardiovascular patients who may suffer from the inevitable decline in physical activities and altered dietary habits [7–9].

The 2019 American College of Cardiology/American Heart Association (ACC/AHA) guideline on the primary prevention of cardiovascular disease suggests that adults should engage in at least 150 minutes per week of accumulated moderate-intensity physical activity or 75 minutes per week of vigorous-intensity physical activity to reduce the risk of atherosclerotic cardiovascular diseases [10]. There have been reports around the world that lockdown has resulted in a variety of negative long-term effects on cardiovascular disease associated with unhealthy lifestyles, stress, and anxiety [7,11]. Limitation of physical activities during isolation could lead to deleterious effects on cardiovascular diseases, especially among patients with myocardial dysfunction, an elevated inflammatory state, oxidation, and hardening of the vessel walls as well as contribute to other cardiovascular risk factors such as obesity, dyslipidemia, and insulin resistance [12].

Investigations on the effects of the COVID-19 pandemic on weight, physical activity and habits have reported unfavorable outcomes on cardiovascular risk factors [13,14]. Delicate lifestyle adjustment and psychological instability that occur during isolation may exacerbate or develop new symptoms such as chest pain, fatigue, and dyspnea which could lead to medication altering, as well as more frequent follow-up among cardiovascular outpatients [15]. At the same time, during a pandemic, people are advised to limit access to hospitals, except in urgent cases. This can lead to poor adherence to treatment, resulting in exacerbation of chronic underlying diseases such as decompensated heart failure [16]. When the cardiovascular risk factors change in a negative direction, such as decreased exercise time, increased weight, and increased stress, these problems cause the patient's blood pressure to fluctuate greatly. In hypertensive patients, blood pressure will become difficult to control with existing treatments, requiring adjustment of the dose of drugs or an increase in the number of groups of drugs to control or lower blood pressure. When blood pressure is unstable in patients

with different underlying diseases that can lead to the exacerbation of chronic underlying diseases, patients may be admitted to hospital because of hypertension crises, hypotension, decompensated heart failure, acute coronary syndrome, and stroke [7,10,12].

Little information about the effect of the COVID-19 pandemic on outpatients with underlying heart diseases has been established [17]. Therefore, we sought to evaluate the impact of the lockdown on the outpatients with chronic underlying cardiovascular diseases and factors associated with unstable blood pressure.

Methodology

Participants, inclusion and exclusion criteria

The study was conducted as a cross-sectional study from April to June 2020 at the University Medical Center (UMC), Ho Chi Minh City, Vietnam. The population chosen for our study was a cohort of adult patients with chronic cardiovascular disease at varying disease stages and medical management. We invited patients who had been examined and treated for any chronic cardiovascular diseases to participate in the study. Participants who met the following criteria were short-listed: (1) aged 18 years or older; (2) able to respond to the questionnaire; (3) accepted to enroll in the study; and (4) had been to at least 3 consecutive follow-up appointments at the outpatient cardiology clinic prior to April 1, 2020.

We randomly selected for every ten patients from a list of eligible subjects to obtain the final set of participants. They were subsequently provided with information about the study and asked to take part in the survey. Patients who enrolled were asked to give written informed consent.

Measures and instruments

Data were collected from the outpatient clinic by staff cardiologists at the UMC outpatient clinic. One-on-one interviews were conducted using a structured questionnaire. Sociodemographic data from the study population, including age, sex, present locale, education, health insurance status, occupation, and routine exercise habits, were collected. Cardiovascular symptoms used to describe the appearance or increase of one or more of the symptoms included left chest pain, dyspnea, and palpitations. We assessed the effects of lockdown period on the patients' lifestyle such as exercise habits, weight changes, blood pressure, and common cardiovascular symptoms, including chest pain, shortness of breath, fatigue, and palpitations. Weight changes and exercise habits were assessed by

the patient himself. The cardiovascular symptoms were evaluated by cardiologists at the outpatient clinic. Follow-up appointments at UMC were defined as patients who had revisited at the UMC outpatient clinic or their local hospitals and those who did not. The latter follow-up group included patients who sought care at their respective cardiology clinics later than the doctor's appointment schedule. A prescription change is defined

as a change in the number of groups of drugs assessed by cardiologists. Finally, patients were divided into two groups according to the stability or not of their blood pressure. Stable blood pressure is defined as the condition where the patient's blood pressure fluctuates within the treatment target according to current therapeutic guidelines and hypotension is absent. Unstable blood pressure is defined as when the patient's

Table 1. Socioeconomic characteristics and factors associated with unstable blood pressures of study population.

	Stable blood pressure N = 431	Unstable blood pressure N = 62	Total N = 493	p-value
Age (years)	62.3 (9.96)	61.9 (12.1)	62.2 (10.2)	0.818
Gender				0.328
Female	190 (44.1%)	32 (51.6%)	222 (45.0%)	
Male	241 (55.9%)	30 (48.4%)	271 (55.0%)	
Employment				0.803
Full time job	159 (36.9%)	24 (38.7%)	183 (37.1%)	
Retired	136 (31.6%)	17 (27.4%)	153 (31.0%)	
Unemployment	136 (31.6%)	21 (33.9%)	157 (31.8%)	
Education				0.321
No formal education	4 (0.93%)	0 (0.00%)	4 (0.81%)	
Primary school	212 (49.2%)	24 (38.7%)	236 (47.9%)	
High school	124 (28.8%)	20 (32.3%)	144 (29.2%)	
University	84 (19.5%)	18 (29.0%)	102 (20.7%)	
Master/ PhD	7 (1.62%)	0 (0.00%)	7 (1.42%)	
Health Insurance				1.000
No	12 (2.78%)	1 (1.61%)	13 (2.64%)	
Yes	419 (97.2%)	61 (98.4%)	480 (97.4%)	
Marital status				0.402
Divorced	1 (0.23%)	0 (0.00%)	1 (0.20%)	
Married	423 (98.1%)	60 (96.8%)	483 (98.0%)	
Single	7 (1.62%)	2 (3.23%)	9 (1.83%)	
Duration of follow-up before lockdown(weeks)	4.79 (1.98)	4.40 (1.25)	4.74 (1.91)	0.038
Duration of follow-up after lockdown(weeks)	6.31 (2.77)	6.94 (2.65)	6.39 (2.76)	0.086
Actual follow-up visit time (weeks)/Scheduled re-examination time (weeks)	1.38 (0.57)	1.62 (0.57)	1.41 (0.57)	0.003
Amount of drug used (type of medicine)	5.31 (1.87)	5.50 (1.89)	5.33 (1.87)	0.457
Follow-up on schedule				0.914
No	139 (32.3%)	19 (30.6%)	158 (32.0%)	
Yes	292 (67.7%)	43 (69.4%)	335 (68.0%)	
Prescriptions have changed				1.000
No	413 (95.8%)	60 (96.8%)	473 (95.9%)	
Yes	18 (4.2%)	2 (3.2%)	20 (4.1%)	
Need for health advice				0.637
No	422 (97.9%)	60 (96.8%)	482 (97.8%)	
Yes	9 (2.1%)	2 (3.2%)	11 (2.2%)	
Bodyweight				0.020
Decrease	29 (6.7%)	2 (3.2%)	31 (6.3%)	
Increase	44 (10.2%)	14 (22.6%)	58 (11.8%)	
No change	358 (83.1%)	46 (74.2%)	404 (81.9%)	
Exercise				0.852
Do not exercise due to doctor's recommendation	20 (4.6%)	2 (3.2%)	22 (4.5%)	
No exercise	29 (6.7%)	2 (3.2%)	31 (6.3%)	
Maintain exercise during lockdown	357 (82.8%)	54 (87.1%)	411 (83.4%)	
Quit training	11 (2.6%)	2 (3.2%)	13 (2.6%)	
Reduce exercise time	14 (3.3%)	2 (3.2%)	16 (3.3%)	
Cardiovascular problems				0.002
No	354 (82.1%)	40 (64.5%)	394 (79.9%)	
Yes	77 (17.9%)	22 (35.5%)	99 (20.1%)	

Note: Unstable blood pressure defined as either increased or decreased from baseline.

blood pressure is out of the treatment target or when the patient presented a condition of hypotension.

Regulations on managing chronic diseases in the hospital require that patients come for follow-up visits on schedule. However, patients can get to the hospital on time, sooner, or later. To assess the impact of the social distance policy on follow-up visits, we used a ratio between "actual visit time (weeks)" and "scheduled follow-up time (weeks)" to evaluate this change.

Ethics statement

This study was carried out in accordance with the Declaration of Helsinki and was approved by the ethics committee of biomedical research at the University of Medicine and Pharmacy, Ho Chi Minh City, number 676/QD-BVDHYD. Patients were invited to participate in the survey during their health maintenance visits. The purpose of the study, including the benefits and drawbacks of participation, was explained to the participants. Participants were also informed that they could withdraw at any time they wanted and that withdrawing from the study would not affect their clinical care in any way. We ensured the confidentiality of participants throughout the study.

Statistical analysis

The 493 patients were split into two groups based on their blood pressure status: stable versus unstable, following COVID-19 lockdown. The COVID-19 lockdown period is defined as the period from April 1st to May 2nd, 2020 and the pre-lockdown period is defined as the period from January to March 2020. Our study assessed the stability of blood pressure during the COVID-19 outbreak, and the outcome variable was assigned two values (stable blood pressure and unstable blood pressure). During the data cleaning process, we excluded participants who did not answer the outcome question (1.4%; 7/500 participants). In the descriptive statistics, with continuous variable, we used t-test to compare the difference between the two groups with stable and unstable blood pressure. For the remaining variables, we used Chi-square test or Phi and Cramer's V to compare the difference between the two groups. For the main analysis, we used the Bayesian Model Averaging (BMA) package, which uses Bayesian model averaging to determine the optimal logistic model. The above analysis methods were performed on R language version 4.0.2 software [18] on Windows 10. Statistical significance was defined when the *p* value was less than 0.05.

Results

The study population consisted of 493 patients with chronic cardiovascular diseases who underwent follow-up at our outpatient department. The study population included subjects with a broad spectrum of cardiovascular diseases including ischemic heart disease, valvular diseases, hypertension, congestive heart failure, atrial fibrillation, and hyperlipidemia. Of these 493 patients, 271 (55%) were male. Mean age of the study population was 62.2 ± 10.2 years. The stable blood pressure group consisted of 431 (87%) individuals of the study population, while the unstable blood pressure group consisted of 62 (13%) individuals of the study population. Many factors were assessed in comparing patients within the two study groups including: follow-up appointment compliance, body weight, exercise habits and adverse cardiovascular problems, as listed in Table 1.

During the pre-lockdown period, the average time between follow-up appointments was 4.7 ± 1.9 weeks (Table 1), and the median number of tablets prescribed to each patient was 5 tablets (interquartile range 25th-75th: 4-7). During lockdown, the average follow-up appointment time was 6.4 ± 2.8 weeks, demonstrating a significant increase in average time between follow-up appointments when comparing the pre-lockdown and lockdown periods (*p* value < 0.05).

When assessing the effect of lockdown on patients' follow-up visit at the clinic, we found that 68% (335/493) of the study population attended their follow-up appointments at UMC as scheduled. Of that 68%, 87% (292/335) of the patients were from the stable blood pressure group, whereas only 13% (43/335) were from the unstable blood pressure group.

For patients with stable versus unstable blood pressures following lockdown, there was no significant difference found regarding patients' exercise habits. Interestingly, a higher percentage of patients in the unstable blood pressure group (87.1%) maintained their exercise regimen during lockdown, while 82.8% of patients in the stable blood pressure group reported maintaining exercise habits during this period.

However, significant differences were found in body weight changes and cardiovascular problems (*p* value < 0.05) between the two groups. For body weight, an increase of 22.6% was reported in patients with unstable blood pressure, as opposed to 10.2% in patients with stable blood pressure. Notably, a decrease was reported in 6.7% of patients with stable blood pressure, whereas only 3.2% of patients with unstable blood pressure reported a decrease in body weight. Furthermore, 35.5% of patients with unstable blood

pressures reported worsening of cardiovascular problems, compared to 17.9% of patients with stable blood pressure reporting worsening cardiovascular problems.

According to Table 2, the significant differences in increased body weight and worsening of cardiovascular problems for patients with unstable blood pressure, as compared to those with stable blood pressure following COVID-19 lockdown, in combination with the overall increased time interval between follow-up appointments during lockdown demonstrated a negative consequence of COVID-19 lockdown on blood pressure for patients with chronic cardiovascular disease.

There were 12 cases requiring consultation from medical staff, accounting for 2.4% of the study population. There were 13 cases (2.6%) where patients required an earlier follow-up appointment as they reported worsening symptoms.

Discussion

This study provided an insight into the effects of the COVID-19 pandemic on patients with chronic underlying cardiovascular disease who were treated during the period of lockdown from March 31 to May 1, 2020 at a major medical center in Vietnam.

To the best of our knowledge, this is the first survey in Vietnam to evaluate the effects of lockdown on patients with chronic underlying cardiovascular disease. Lockdown has brought positive results in preventing and controlling the COVID-19 epidemic in Vietnam, and has been applied in many countries around the world. In Vietnam, since the first case reports, the government has taken steps to reduce the spread of the disease in the society [19]. The enforcement of lockdown in Vietnam took place over four weeks starting March 31, 2020 [20]. Here, we examined the effects of this lockdown period on patients when they returned for follow-up at the outpatient clinic, after a 4-week interval.

We directly interviewed 493 outpatients with cardiovascular diseases who returned for re-examination at the outpatient cardiology clinic. The results suggest that the pandemic and the lockdown period that ensued potentially exerted negative consequences on cardiovascular risk factors. Specifically, 31.6% of patients did not come for their scheduled follow-up appointment. Among those included in the study, 3.3% reported a reduction in exercise, and 2.6% reported stopping exercising altogether. Common predictors of cardiovascular risk factors also changed in a negative direction in a portion of the study population. These included fluctuating weight, difficult to control blood pressure, and daily cardiovascular symptoms becoming harder to control. No data from pre-pandemic period were available for comparison.

Our results suggest a trend in reduction of exercise habits during COVID-19 pandemic, consistent with findings from other studies around the world [21,22]. Decreased physical activity or inactivity during this period may be associated with poor metabolic effects resulting in increased cardiovascular risk. According to the Heart and Stroke Foundation of Canada, cardiovascular diseases caused 36% of the deaths in 2001, and most patients exhibited at least one risk factor of cardiovascular disease such as tobacco smoking, physical inactivity diabetes, obesity, hypertension, lack of daily fruit and vegetable consumption, and psychosocial factors [23,24]. In another study by Thopson PD *et al.*, exercise is associated with 30% benefit in terms of decreased cardiac risk [25]. Sudden exercise cessation can lead to insulin resistance in muscle tissue and impaired muscle cell glucose uptake [26]. In our study, about one-third of the patients decreased physical activity or were inactive during the quarantine lock down period. This can negatively affect the patient’s underlying medical condition. A survey in Italy showed that outdoor physical activities, such as walking, jogging, and swimming, decreased significantly when compared before and during

Table 2. Multivariable regression analysis of factors influencing unstable blood pressure.

	Univariable		Multivariable	
	OR (95% CI)	<i>p</i>	OR (95% CI)	<i>p</i>
Actual follow-up visit time (weeks) / Scheduled re-examination time (weeks)	1.91 (1.25 – 2.91)	0.003	1.91 (1.24 – 2.96)	0.003
Body weight				
No change	Reference		Reference	
Increase	2.48 (1.23 – 4.78)	0.008	2.35 (1.14 – 4.64)	0.016
Decrease	0.54 (0.09 – 1.86)	0.405	0.49 (0.08 – 1.76)	0.348
Cardiovascular problems				
No	Reference		Reference	
Yes	2.53 (1.40 – 4.46)	0.002	2.49 (1.36 – 4.49)	0.003

COVID-19 pandemic [26]. Restricted physical activity and sedentary lifestyles are associated with an increased risk of cardiovascular disease, as well as leading to several metabolic and psychological consequences, which also contribute to an increased risk factor for cardiomyopathy [27]. Several mechanisms have been proposed for the beneficial effects of regular exercise, including a reduction in chronic inflammation through improvement of endovascular function and an increase in the ability to regenerate after the endothelium is damaged [28].

Furthermore, we found that 12.4% of the patients interviewed had difficulty controlling their blood pressure during the lockdown period. This can be attributed to many factors such as interval stress and an increase in the sedentary lifestyle. An important contributing factor was the lack of medication adjustment by cardiologists, as 31.6% of the study population failed to go to their scheduled follow-up visits during this period. This study revealed that 12% of the patients reported weight gain, while 6.3% reported weight loss during the 4-week period. The number of patients who gained weight was nearly double of those with weight loss. In another study by Di Renzo *et al.*, 40.3% of patients reported weight gain and 13.9% reported weight loss [26].

Adherence to medications and follow-up schedules can be daunting in the best of times, and the COVID-19 pandemic threatened to worsen the problems [29]. Vietnam is a middle-income country according to World Bank statistics and the healthcare system is relatively undeveloped [30]. Previous studies conducted in Vietnam revealed that medication adherence rate was relatively low among subjects with cardiovascular disease [31,32]. It is conceivable that this rate may be even lower during the lockdown period among patients with chronic underlying cardiovascular disease. We found that 19.8% of the surveyed patients reported negative changes in daily cardiovascular symptoms such as chest pain, shortness of breath, palpitations. We attribute these adverse outcomes to changes in physical exercise habits, inadequate blood pressure control, and failure to go to follow-up appointments. In another study by Aragona *et al.*, the number of the patients who visited in February 2020 and returned for their follow-up visits in March 2020 declined from approximately 30% over the same months in 2017–2019 to 17.53% in March 2020 [33].

In lieu of these concerning trends, the American Society of Preventive Medicine and American Heart Association have issued recommendations for the management of patients with cardiovascular diseases to

maintain a healthy lifestyle that involves physical activity, nutrition, weight management and smoking cessation [34,35]. Telemedicine or virtual clinic appointments is gaining popularity as a solution to maintain close patient follow-up in the setting of the COVID-19 pandemic [36].

Limitations

This is a cross-sectional survey over a short period, based on one-on-one interviews with patients. There are many limitations in this approach including memory and recall bias. Another limitation would be that the bodyweight, daily common symptoms, and physical activity level were self-reported, making underestimation or overestimation possible. In addition, this is a single-center survey study in Vietnam, limiting its generalizability.

Conclusions

Several aspects related to cardiovascular risk factors were found to move in a negative direction during the lockdown period, including physical activity, changes in weight, and inadequate blood pressure control. A substantial portion of patients also failed to attend their follow-up visits and reported a worsening of cardiovascular symptoms. However, this study is a survey in only a single center. In the future, it is necessary to conduct surveys with larger number of patients with a larger scope in order to fully understand the effects of lockdown on patients with chronic underlying cardiovascular diseases in middle-income countries such as Vietnam.

Authors' Contributions

Concept or design: Hoang Van Sy, Nguyen Tien Huy; Supervisor: Hoang Van Sy, Nguyen Tien Huy, Nguyen Minh Kha; Acquisition of data: Truong Van Le, Nguyen Minh Kha, Le Thi Anh Hoa, Nacir Dhoubi; Analysis: Hoang Van Sy, Truong Van Le, Khoa Le Anh Huynh, Le Thi Anh Hoa, Nicole Vuong, Nacir Dhoubi, Au Thanh Tung, Tien-Phat V. Huynh; Drafting of the manuscript: Hoang Van Sy, Nguyen Minh Kha, Le Thi Anh Hoa, Au Thanh Tung, Tien-Phat V. Huynh, Le Van Truong, Khoa Le Anh Huynh, Nicole Vuong, Nacir Dhoubi, Nguyen Tien Huy; Critical revision of the manuscript for important intellectual content: Hoang Van Sy, Nguyen Tien Huy, Nguyen Minh Kha; All authors had full access to the data, contributed to the study, approved the final version for publication, and take responsibility for its accuracy and integrity. All authors read and approved the final manuscript.

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