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COVID-19

Impact of the COVID-19 Lockdown Strategy on Vascular Surgery Practice: More Major Amputations than Usual

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Background: The aim of this study is to investigate the impact of the coronavirus disease 2019 (COVID-19) lockdown period on the number and type of vascular procedures performed in the operating theater.

Methods: A total of 38 patients who underwent 46 vascular procedures during the lockdown period of March 16th until April 30th, 2020, were included. The control groups consisted of 29 patients in 2019 and 54 patients in 2018 who underwent 36 and 66 vascular procedures, respectively, in the same time period. Data were analyzed using SPSS Statistics.

Results: Our study shows that the lockdown during the COVID-19 pandemic resulted in a significant increase in the number of major amputations (42% in 2020 vs. 18% and 15% in 2019 and 2020, respectively; *P*-value 0.019). Furthermore, we observed a statistically significant difference in the degree of tissue loss as categorized by the Rutherford classification (*P*-value 0.007). During the lockdown period, patients presented with more extensive ischemic damage when than previous years. We observed no difference in vascular surgical care for patients with an aortic aneurysm.

Conclusions: Measurements taken during the lockdown period have a significant effect on non-COVID-19 vascular patient care, which leads to an increased severe morbidity. In the future, policy makers should be aware of the impact of their measurements on vulnerable patient groups such as those with peripheral arterial occlusive disease. For these patients, medical care should be easily accessible and adequate.

INTRODUCTION

In December 2019, a new cluster of pneumonia was reported in Wuhan, China, which was linked to a novel coronavirus on January 7th, 2020.¹ This severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) spread rapidly, and on January 30th, the World Health Organization declared a public health emergency of international concern.² In the Netherlands, the first infection was confirmed on February 27th, 2020. A week later, on March 3rd, the first patient tested positive at our hospital. In the following days, the number of infections increased, which led to an intelligent lockdown on March 16th, 2020. At that moment, 184 patients with SARS-CoV-2 infection were admitted to the hospital in the Netherlands.³ The pandemic

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Table I. Patient characteristics

Parameters	2020	2019	2018	P-value ^a
	n = 38	n = 29	n = 54	
Age (mean; range)	71 (30–86)	69 (53–88)	70 (49–90)	0.635
Sex				0.485
Female	12 (32)	7 (24)	20 (37)	
Male	26 (68)	22 (76)	34 (63)	
BMI (mean; range)	25.8 (18.2–38.6)	24.2 (16.5–30.9)	24.9 (15.6–33.8)	0.546
Smoking status				0.061
Active	27 (71)	17 (59)	40 (74)	
Never	10 (26)	5 (17)	10 (19)	
Unknown	1 (3)	7 (24)	4 (7)	
Comorbidities				
Diabetes	10 (26)	10 (35)	13 (24)	0.694
Hypertension	30 (79)	18 (62)	43 (80)	0.260
Hypercholesterolemia	26 (68)	14 (48)	34 (63)	0.315
Coronary artery disease	8 (21)	10 (34)	17 (31)	0.416
Atrial fibrillation	10 (26)	5 (17)	14 (26)	0.622
Chronic obstructive pulmonary disease	9 (24)	7 (24)	15 (28)	0.887
Obstructive sleep apnea	1 (3)	2 (7)	4 (7)	0.601
History of stroke	3 (8)	6 (21)	10 (19)	0.270
History of vascular surgery				
Minor amputation	3 (8)	3 (10)	3 (6)	0.724
Major amputation	1 (3)	3 (10)	4 (7)	0.431
Aneurysm surgery	3 (8)	0 (0)	2 (4)	0.268
Peripheral vascular surgery	21 (55)	12 (41)	21 (39)	0.375
Positive COVID-19 status	2 (5)			
Diagnosis	10 (26)	7 (24)	15 (28)	0.848
Aortic aneurysm	19 (50)	17 (59)	31 (57)	
Chronic limb ischemia	5 (13)	4 (14)	6 (11)	
Acute embolus	4 (11)	1 (3)	2 (4)	
Other				

Values are numbers (percentages) unless stated otherwise.

BMI, body mass index; ANOVA, analysis of variance.

^aChi-squared test with the Bonferroni correction for categorical variables; the ANOVA test for continuous variables.

continued despite all measurements taken, and within 3 weeks' time, 1,314 patients with SARS-CoV-2 infection were admitted to the intensive care unit in the Netherlands.⁴ Our hospital is situated in one of the regions in the Netherlands that was most affected by the novel coronavirus.³

Owing to the increasing number of coronavirus disease 2019 (COVID-19) infections and hospital admissions, there was a shift from providing regular health care toward urgent services only. Most outpatient and primary care physician (PCP) visits were minimized, and consults were mainly performed by phone. Physical examinations were reduced significantly, which may have led to delays in diagnosis and treatment of patients without COVID-19. In line with this, Sena and Galleli (2020)⁵ describe a significantly greater number of amputations performed in their surgery department during the COVID-19 lockdown in Italy. In our clinic, all elective

surgeries were postponed; only urgent surgical care was delivered. Patients with clinical symptoms of COVID-19 underwent testing by nasopharyngeal swab or computed tomography scan of the thorax. There was a separate operating theater for patients undergoing surgery who tested positive or with high clinical suspicion. The aim of our study is to investigate the effect of the intelligent lockdown in the Netherlands on all major vascular surgery procedures performed in the operating theater of our hospital.

During the COVID-19 pandemic, new guidelines were introduced to prioritize patients for surgical intervention.⁶ Patients suffering from peripheral arterial disease with severe limb ischemia (Rutherford grade 4 or higher) and patients with an aortic aneurysm > 7.0 cm were classified as urgent.⁷ Therefore, in this article, we focus on patients undergoing urgent surgical intervention for either limb ischemia (acute or chronic) or an aortic aneurysm.

Table II. Presentation of patients with chronic limb ischemia

Parameters	2020 n = 19	2019 n = 17	2018 n = 31	P-value ^a
Rutherford classification				0.007 ^b
Grade I			1 (3)	
Grade II		1 (6)	6 (19)	
Grade III	1 (5) ^c	5 (29) ^c	1 (3)	
Grade IV	1 (5)	4 (24)	8 (26)	
Grade V and VI	17 (90) ^d	7 (41)	15 (48)	
Diabetic foot present	3	2	5	0.914

Values are numbers (percentages) unless stated otherwise.

^aChi-squared test with the Bonferroni correction.

^bP-value < .05.

^cStatistically significant difference between the observed number of patients in 2020 and 2019.

^dThe observed number of patients in 2020 differs significantly from 2019 to 2018.

METHODS

Patient Characteristics

All patients who underwent vascular surgery for peripheral arterial disease or an aortic aneurysm during the COVID-19 intelligent lockdown period (March 16, 2020–April 30, 2020) at the Amphia hospital in Breda, the Netherlands, were included in this study. The control group consisted of all patients who underwent vascular surgery in the same period in 2019 and 2018. Patient characteristics including the age, gender, and comorbidities were retrieved from electronic medical records. If patients underwent multiple interventions during the study period, we documented them as separate records linked to one patient. The COVID-19 status was determined on either nasopharyngeal swab or imaging of the thorax.

For patients with chronic peripheral arterial occlusive disease, the Rutherford classification system was used to record the extent of the disease.⁷ Rutherford V (minor tissue loss) and VI (major tissue loss) were classified as one category (tissue loss) because categorizing the difference between both categories retrospectively from patient records could not be performed objectively.

Our research was approved by the local review board of the Amphia Hospital.

Outcome Measurements

The primary outcome measures were the number and type of procedures performed. Surgical procedures were either related to limb ischemia or abdominal aortic aneurysm repair. Amputations were divided in two different categories. Major limb amputation was defined as an amputation above

the level of the ankle.⁸ Amputations of the foot or digit were classified as minor limb amputations.

Statistical Analysis

Descriptive statistics were used to present baseline characteristics and outcome measures. Categorical variables are presented as numbers with percentages. Continuous variables are presented as means with range. The chi-squared test was used to test for significant differences between categorical variables. A Bonferroni correction was performed for the chi-squared tests to correct for multiple testing. For continuous variables, an analysis of variance test was performed for multiple testing. Data were analyzed using SPSS Statistics.

RESULTS

Patient Characteristics

In total, 38 patients underwent vascular surgery during the COVID-19 lockdown period, compared with 29 patients during the same period in 2019 and 54 in 2018. The baseline characteristics of all patients are presented in [Table I](#). There were no statistically significant differences between the groups at baseline. In the population of 2020, only 2 of the 38 patients tested positive for COVID-19.

Peripheral Arterial Obstructive Disease

During the lockdown period in 2020, 19 patients with peripheral arterial obstructive disease underwent surgery for chronic limb ischemia. We observed a statistically significant difference in the degree of tissue loss as categorized by the Rutherford classification in these patients compared with the control groups ([Table II](#)). The number of patients

Table III. Vascular surgical interventions

Intervention	2020 n = 36	2019 n = 28	2018 n = 51	P-value ^a
Minor amputations		3 (11)	1 (2)	0.019 ^b
Major amputations	15 (42) ^c	5 (18)	8 (15) ^c	
Bypass surgery	9 (25)	7 (25)	11 (21)	
Endarterectomy	1 (3) ^c	5 (18)	13 (24) ^c	
Embolectomy	6 (16)	6 (21)	10 (19)	
Other	5 (14)	2 (7)	10 (19)	

Values are numbers (percentages) unless stated otherwise.

^aChi-squared test with the Bonferroni correction.

^bP-value <.05.

^cStatistically significant difference between the observed numbers 2020 and 2018.

Table IV. Presentation and treatment of patients with an aortic aneurysm

Parameters	2020 n = 10	2019 n = 7	2018 n = 15	P-value ^a
Aortic aneurysm				0.582
Asymptomatic	5 (50)	6 (86)	11 (73)	
Symptomatic	3 (30)	0	1 (7)	
Ruptured	2 (20)	1 (14)	3 (20)	
Diameter of the aortic aneurysm	72.1 (58–110)	59.9 (52–78)	64.2 (43–93)	0.175
Endovascular aortic reconstruction	5 (50)	6 (86)	6 (40)	0.131
Open reconstruction	5 (50)	1 (14)	9 (60)	

Values are numbers (percentages) unless stated otherwise.

^aChi-squared test with the Bonferroni correction.

presenting with Rutherford grade V/VI (90%) was significantly higher during the lockdown period, whereas the number of patients presenting with Rutherford grade III (5%) peripheral arterial occlusive disease was significantly lower (P -value = 0.007). There was no significant difference in the number of patients presenting with ischemia due to a diabetic foot (Table III) or acute limb ischemia (Table I).

Surgical Interventions for Limb Ischemia

Vascular interventions for critical limb ischemia (chronic or acute) are focused on either revascularization of the limb or removal of ischemic necrotic tissue. During the 2020 lockdown period, 36 surgical peripheral vascular interventions were performed (Table III). The type of surgery performed during this period differed significantly from the type of surgery performed during the previous years (P -value = 0.019). Significantly more major amputations (15 (42%) in 2020, 5 (18%) in 2019, and 8 (15%) in 2018) were performed during the lockdown period in 2020 and significantly less

endarterectomies than those in the same period in 2018 (Table III). Of all major amputations performed in our study population, only two were performed for acute limb ischemia, both in the 2020 cohort (2/15).

Aortic Aneurysm

During the COVID-19 lockdown period, 10 patients underwent surgery for an aortic aneurysm. We observed no differences for aortic surgery in the different periods (Table IV).

DISCUSSION

This study shows that during the COVID-19 lockdown period, there was a significant difference in the number and type of peripheral vascular surgeries performed. More major amputations (15 (42%) in 2020, 5 (18%) in 2019, and 8 (15%) in 2018) were performed, whereas the number of endarterectomies was significantly less. Major amputation leads to severe morbidity and is associated with a high 1-year mortality rate of 44%.⁹

Moreover, patients with chronic limb ischemia who underwent surgery presented with a higher Rutherford grade of ischemic damage. We observed no difference in vascular surgical care for patients with an aortic aneurysm.

There are several limitations of this study. First, this was a retrospective study. Second, owing to the nature of our research question and the short period of the intelligent lockdown in the Netherlands, the number of patients and surgical interventions is small. However, Sena and Galleli (2020) describe the same findings in their study during the lockdown period in Italy.⁵ They report 9 amputations during the lockdown period in 2020 compared with 5 amputations in 2019.⁵ We recommend further investigation of the reported effects in a multicenter study.

In our study population, COVID-19 itself and its hypercoagulable state do not seem to play a major role in the differences observed because only two patients tested positive for SARS-CoV-2.¹⁰ One possible explanation for the observed differences is that the usual standard of care delivered by PCP services and outpatient clinics was minimized or even absent. Most visits were replaced by phone or video consults. Wounds related to ischemic damage of patients with peripheral arterial occlusive disease were therefore possibly not cared for sufficiently. Patient delay may also have been an important factor, with patients being afraid to get infected when visiting a physician. Moreover, patient delay may also have occurred if patients felt they would have been a burden to health-care professionals dealing with patients with COVID-19. It can be hypothesized that COVID-19 did play a role in the increased number of amputations because of false-negative results of the nasopharyngeal swab.¹¹ In our study population, no changes were made in anticoagulant therapy for patients with peripheral arterial occlusive disease during the lockdown period.

Patients with limb ischemia are a fragile and vulnerable group of patients¹² whose outcomes are negatively affected if the usual standard of care is delayed. It is therefore important that during a future pandemic, regular medical care should continue for these patients, with caregivers being aware of these patients and referring in time for revascularization. The increased number of major limb amputations seen in this study may have a large impact on the functional outcome, quality of life, and should thus be prevented.¹³ Finally, although social distancing is critical for eliminating the spread of the SARS-CoV-2 virus, patients should not have to be afraid to visit their physician. An accurate assessment of wounds and tissue loss is

essential in these patients, through either high-quality electronic video or photo consultation or physical examination.

CONCLUSION

The measurements taken during the COVID-19 lockdown period have had a significant effect on non-COVID-19 vascular patient care. This has resulted in an increase in the number of major amputations, leading to more severe morbidity. Policy makers and physicians should be aware of the impact on vulnerable patients, such as those with peripheral arterial occlusive disease. For these patients, medical care should be easily accessible and adequate during a future pandemic.

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