

Treating Peripheral Arterial Occlusive Disease and Acute Limb Ischemia During a COVID-19 Pandemic in 2020

W Exelmans,¹ L Knaapen,² LJM Boonman-de Winter,^{3,4} PWHE Vriens,² and L van der Laan,^{1,5}
Breda, The Netherlands; Tilburg, The Netherlands; Goes, The Netherlands; Leuven, Belgium

Background: For many surgeons the outbreak of SARS-CoV-2 meant a downscaling of surgical interventions. The aim of this study was to investigate the impact of the measures taken on the care for patients with peripheral arterial disease (PAOD) and acute limb ischemia (ALI).

Methods: A retrospective analysis of the vascular practices of 2 major teaching hospitals in the Netherlands was performed. All interventions and outpatient visits for PAOD or ALI in 2020 were included. Patients treated in 2018 and 2019 were to serve as a control group. Data were analysed using descriptive statistics.

Results: In 2020, a total of 1513 procedures were performed for PAOD or ALI. This did not differ significantly from previous years. Overall, Fontaine 2 and 4 were the most frequent indications for intervention. A significant increase in the number of major amputations was observed in 2020 compared to 2018 ($P < 0.01$). This was mainly due to patients suffering from PAOD Fontaine 4. Inversely, a reduction in the number of femoro-popliteal bypasses was observed between 2020 and 2018. The number of outpatient visit due to Fontaine 2 was significantly lower in 2020 compared to 2018.

Conclusions: The vascular practices of our hospitals were minimally influenced by the measures taken due to the outbreak of SARS-CoV-2. There was an increase in the number of amputation but an enormous surge in patients presenting with critical limb ischemia was not observed.

INTRODUCTION

In 2020 vascular surgeons worldwide had to alter their practices due to the outbreak of the severe

acute respiratory syndrome coronavirus 2 (SARS-CoV-2).¹⁻³ When the number of infected patients requiring hospital admission rose, operating time and outpatient visits were reduced. During 2020 the Dutch government proclaimed 2 periods of national lockdown. The first was from 16 March until the 11 May 2020 and the second from 14 of October 2020 until the end of the year. This meant a partial shutdown of public life. During these periods operating capacity was reviewed on a weekly basis and surgical procedures were prioritized using recommendations issued by the Dutch Society for Surgery.⁴ Previous research from our group demonstrated an increased number of major amputations during the first lockdown period.⁵ Although many publications describe the reality during one lockdown period, data is lacking that describes an entire year. The present study therefore evaluates the number of procedures for peripheral arterial occlusive disease (PAOD) and acute limb ischemia (ALI) during 2020 in 2

Conflicts of Interest: We know of no conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

¹Department of Surgery, Amphia Hospital, Breda, The Netherlands

²Department of Surgery, Elisabeth-Twee Steden Hospital, Tilburg, The Netherlands

³Department of Science and Statistics, Amphia Hospital, Breda, The Netherlands

⁴Management Board, Admiraal de Ruyter Hospital, Goes, The Netherlands

⁵Department of Cardiovascular science, University of Leuven, Leuven, Belgium

Correspondence to: Ward Exelmans MD, Amphia Hospital Breda, Department of Surgery, Molengracht 21, 4818 CK Breda PO Box 90157, 4800 Breda, The Netherlands; E-mail: ward.exelmans@uzleuven.be

Ann Vasc Surg 2022; 84: 1–5

<https://doi.org/10.1016/j.avsg.2022.01.012>

© 2022 Elsevier Inc. All rights reserved.

Manuscript received: November 22, 2021; manuscript accepted: January 5, 2022; published online: 31 January 2022

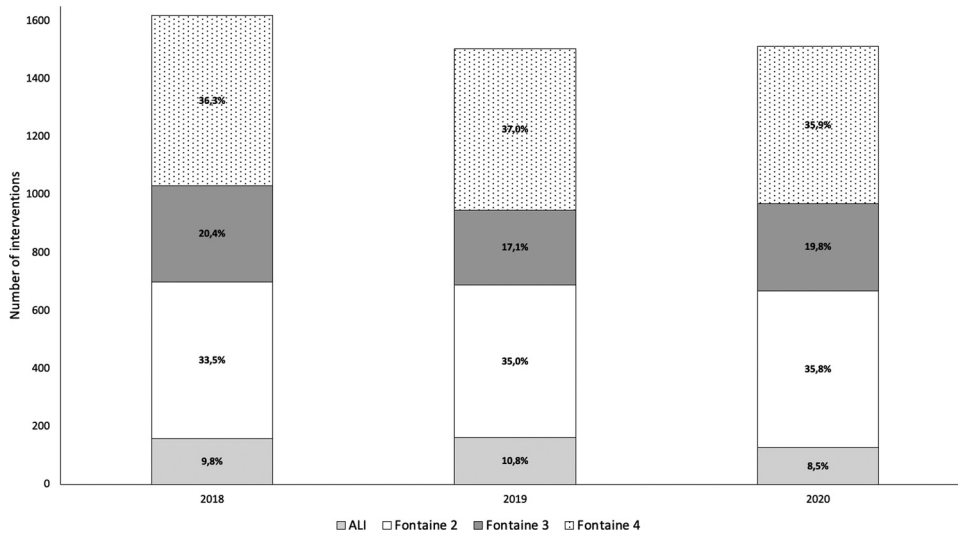


Fig. 1. Indications for vascular interventions per year.

large teaching hospitals in the province of Noord-Brabant, The Netherlands.

METHODS

Patients

A procedure-based query was applied to the electronic health record of both hospitals. All interventions for PAOD and ALI from 1 January 2020 until 31 December 2020 were included. Procedures performed during the same period in 2018 and 2019 served as a control group. Interventions are classified in one of the following categories: angioplasty/stenting, endarterectomy, femoro-popliteal bypass, femoro-distal bypass, embolectomy/thrombolysis, and major limb amputations. Major limb amputation is defined as an amputation above the level of the ankle.

In case of PAOD the Fontaine classification is used: Fontaine 2 (claudication), Fontaine 3 (ischemic rest pain or nocturnal pain), Fontaine 4 (necrosis and/or gangrene). For ALI no further classification is used. All interventions for aneurysmal disease, carotid artery disease and minor amputations (foot and digits) were excluded. Similarly, we collected data on visits to our outpatient clinic. Visits linked to a new diagnosis of PAOD or ALI were eligible for inclusion. This study was approved by the local ethics committees in both hospitals and informed consent was waived.

Outcome measures

The primary outcomes are the number and type of procedures performed. Secondary outcome is the

indication for the intervention. For the outpatient clinic this is the number of visits.

Statistical analysis

Descriptive statistics are 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 is used to test for significant differences between categorical variables. For continuous variables, an analysis of variance test is performed for multiple testing. Data were analyzed using SPSS Statistics version 25.

RESULTS

In 2020, a total of 1513 procedures for PAOD or ALI were performed in 885 patients. In comparison, 1619 procedures were performed in 889 patients in 2018 and 1504 procedures in 885 patients in 2019. The mean number of procedures per month in 2020 was 126 ± 21.3 . In 2018 and 2019 this number was 135 ± 13.4 and 125 ± 13.8 (Table 1). No significant difference in age or sex was found between the investigated years.

There was no significant difference in the total number of peripheral vascular procedures between 2020 and the control years. Fontaine 2 and 4 were the most frequent indications for intervention in all years (Fig. 1).

More major limb amputations were performed in 2020 ($n = 111$) compared to 2019 ($n = 81$) and 2018 ($n = 70$). The increase in 2020 was significant compared to 2018 ($P < 0.01$) but not in comparison to 2019 (Fig. 2). This increase was

Table I. Number of procedures and patients treated for peripheral arterial disease and acute limb ischemia with demographics presented per year.

	2018	2019	2020	<i>p</i> -value*
Number of procedures per month	1619	1504	1513	
Mean number of procedures per month	135 ± 13.4	126 ± 21.3	.301	
Number of patients	888	889	885	
Male	525 (59.1)	559 (62.9)	521 (60.9)	.267
Age	70.1±10.4	71.8±10.4	71.0±10.3	.156

Data are presented as n (%) or mean ± standard deviation.

*Chi-squared test for categorical variables; ANOVA test for continuous variables.

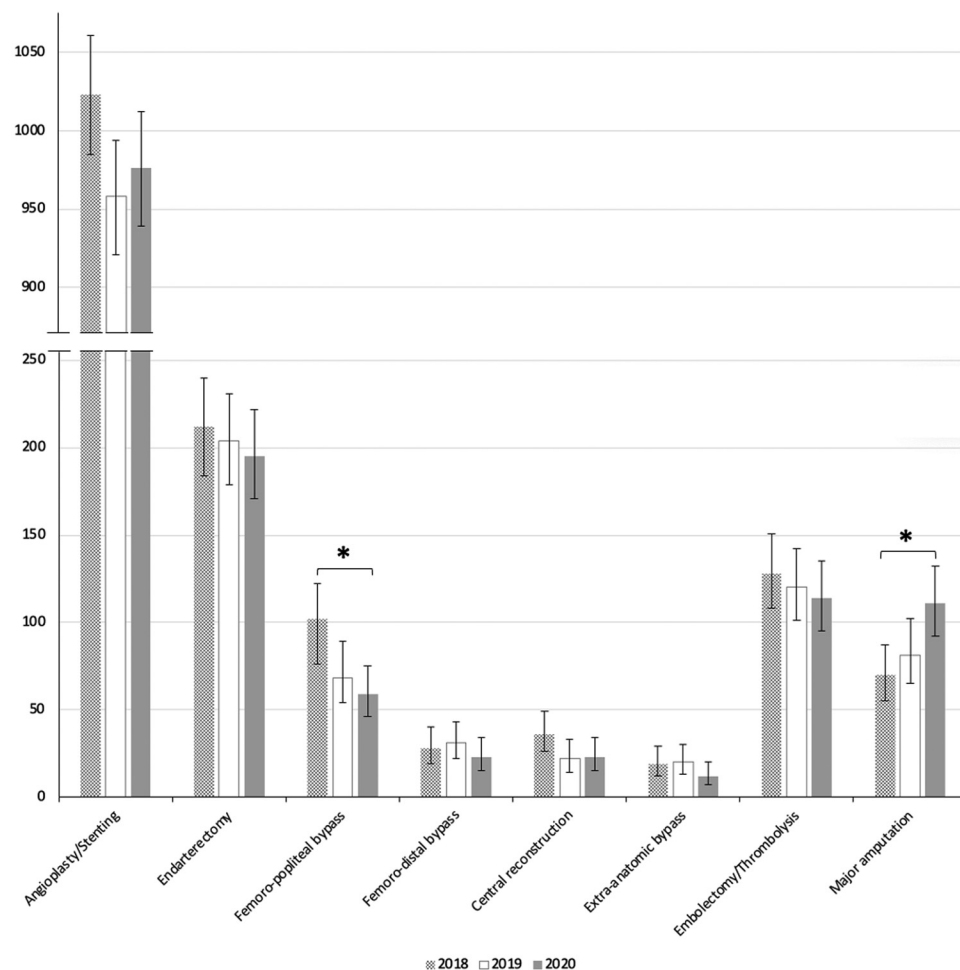


Fig. 2. The number of procedures performed per year. A Chi-squared analysis was performed. * $P < 0.01$.

mainly in patients suffering from PAOD Fontaine 4 (53 or 75.7% in 2018 vs 92 or 82.9% in 2020). Moreover, a significant ($P < 0.01$) reduction in the number of femoro-popliteal bypasses was observed between 2020 ($n = 59$) and 2018 ($n = 102$). Similar to the major amputations, the reduction of femoro-popliteal bypasses compared to 2019 ($n = 68$) was not significant. We found no significant difference in all other categories of procedures.

In total, ALI was the indication for intervention in 128 cases (8.5%; 95% CI [7.1–9.9]). This did not differ significantly from 159 cases (9.8%; 95% CI [8.4–11.3]) in 2018 or 163 cases (10.8%; 95% CI [9.3–12.4]) in 2019.

At the outpatient clinic there was a marked drop of visits for Fontaine 2 in March and April 2020 (Fig. 3). Overall, 845 (61.50%; 95% CI [58.93–64.07]) new patients with Fontaine 2 were treated.

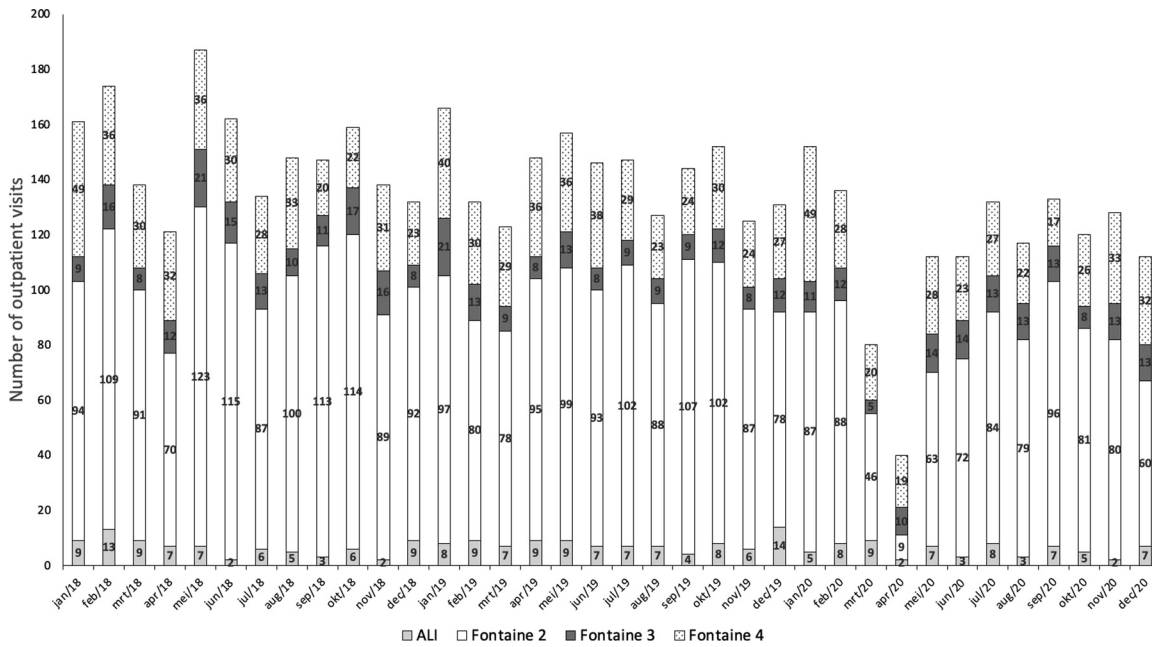


Fig. 3. Absolute number of outpatient visits per month.

This differed significantly from 1841 (67.19%; 95% CI [65.05–69.34]) patients in 2018 but not from 1698 (65.14%; 95% CI [62.87–67.40]) patients in 2019. No significant differences were found in the number of new patients with Fontaine 3, Fontaine 4 or ALI.

DISCUSSION

In general, the rapid spread of SARS-CoV-2 forced hospitals to redirect medical resources and prioritize surgical interventions. This study could not find a significant difference in the total number of interventions for PAOD or ALI between the investigated years. However, studies that looked at the impact of the first wave of SARS-CoV-2 infections describe a reduction in the number of interventions.^{6–8} There are varying observations in studies that look at a longer period of time. In Sweden no significant reduction in the number of vascular interventions was observed when comparing 2020 to the previous years,⁹ taking into account that they had no formal period of lockdown. Reports from Massachusetts observe a decline in procedures between 18 March 2020 and the end of the year, even after resumption of normal services.¹⁰ Initiatives like the Vascular Surgery COVID-19 Collaborative (VASCC)¹¹ and the COVID-19 Vascular Service (COVER) study¹² will hopefully further elucidate the impact of de SARS-CoV-2 pandemic on vascular practices worldwide.

Previous research suggests an increase in the number of major amputations.^{1,2,5,10,13} In the present study, we confirmed these findings. This mainly due to an increase in amputations for Fontaine 4. As in earlier publications this is ascribed to a delay in presentation in a more recent report¹⁰. Inverse to the number of amputations we saw a reduction in the number of femoro-popliteal bypasses, an operation typically performed in patients with Fontaine 4. This reduction in lower extremity revascularization was observed by some¹⁰ but not by other authors.^{1,2} Interestingly, the number of interventions for ALI was not significantly altered in the present study. Since the effect of SARS-CoV-2 on the prevalence of arterial thrombosis is still uncertain,¹⁴ our findings might help comprehend this along with data from future publications.

Our results are in line with others studies that reported a reduction in the number of outpatient visits during the first wave of SARS-CoV-2 infections.^{1,7,13} This is mainly due to a reduction in the number of patients presenting with Fontaine 2. The number of patients with Fontaine 3 and 4 remained somewhat constant.

One of the strengths of the present study is its large sample size from 2 hospitals. It investigated a longer period of time than previous studies. The choice for the evaluation of a calendar year was made from a hospital management perspective. From a disease perspective a year starting in March might have been more suitable.

Another limitation of this study is its retrospective nature.

CONCLUSION

The vascular practices of our hospitals were minimally influenced by the measures taken due to the outbreak of SARS-CoV-2. There was an increase in the number of amputation but an enormous surge in patients presenting with critical limb ischemia was not observed. Continued reporting on changes in our practice are needed to fully comprehend the impact of the ongoing pandemic.

AUTHOR CONTRIBUTIONS

Exelmans W: Conception and design; Analysis and Interpretation; Data Collection; Writing the Manuscript; Approval of the Manuscript; Agreement to be Accountable; Statistical Analysis. Knaapen L: Conception and design; Analysis and Interpretation; Data collection; Writing the Manuscript; Approval of the Manuscript; Agreement to be Accountable. Boonman-de Winter LJM: Analysis and interpretation; Critical Revision; Approval of the Manuscript; Agreement to be Accountable; Statistical Analysis. Vriens PWHE: Conception and Design; Analysis and Interpretation; Critical Revision; Approval of the Manuscript; Agreement to be Accountable. Van der Laan L: Conception and Design; Analysis and Interpretation; Critical Revision; Approval of the Manuscript; Agreement to be Accountable.

REFERENCES

- (1) Lancaster EM, Wu B, Iannuzzi J, et al. Impact of the coronavirus disease 2019 pandemic on an academic vascular practice and a multidisciplinary limb preservation program. *J Vasc Surg* 2020;72:1850–5. doi:10.1016/j.jvs.2020.08.132.
- (2) Ng JJ, Gan TRX, Niam JY, et al. Experience from a Singapore tertiary hospital with restructuring of a vascular surgery

- practice in response to national and institutional policies during the COVID-19 pandemic. *J Vasc Surg* 2020;72:1166–72. doi:10.1016/j.jvs.2020.05.026.
- (3) Mouawad NJ, Woo K, Malgor RD, et al. The impact of the COVID-19 pandemic on vascular surgery practice in the United States. *J Vasc Surg* 2021;73:772–9 e4https://doi.org/. doi:10.1016/j.jvs.2020.08.036.
- (4) Nederlandse Vereniging voor Heelkunde. Handvat voor chirurgische ingrepen tijdens Corona crisis. [cited 2021 Jun 8]. <https://heelkunde.nl/nieuws/nieuwsbericht?newsitemid=23658500>.
- (5) Schuivens PME, Buijs M, Boonman-de Winter L, et al. Impact of the COVID-19 lockdown strategy on vascular surgery practice: more major amputations than usual. *Ann Vasc Surg* 2020;69:74–9. doi:10.1016/j.avsg.2020.07.025.
- (6) Li W, Chen X, Feng H. Impact of COVID-19 on peripheral arterial disease treatment. *Ann Vasc Surg* 2020;67:6–7. doi:10.1016/j.avsg.2020.05.045.
- (7) Mirza AK, Manunga J, Skeik N. Indirect casualties of COVID-19: perspectives from an American vascular surgery practice at a tertiary care centre. *Br J Surg* 2020;107:e246.
- (8) Latz CA, Boitano IT, Png CYM, et al. Early vascular surgery response to the COVID-19 pandemic: results of a nationwide survey. *J Vasc Surg* 2021;73:372–80. doi:10.1016/j.jvs.2020.05.032.
- (9) Björse K, Blomgren L, Holsti M, et al. The impact of Covid-19 on Vascular Procedures in Sweden 2020. *Eur J Vasc Endovasc Surg* 2021;62:136–7. doi:10.1016/j.ejvs.2021.04.027.
- (10) Feliz JD, Ozaki CK, Belkin M, et al. Changes in vascular surgery practice patterns 1 year into the COVID-19 pandemic. *J Vasc Surg* 2021;74:683–4 <http://dx.doi.org/>. doi:10.1016/j.jvs.2021.04.022.
- (11) D’Oria M, Mills JL, Cohnert T, et al. The “Vascular Surgery COVID-19 Collaborative” (VASCC). *Eur J Vasc Endovasc Surg* 2020;60:489–90. doi:10.1016/j.ejvs.2020.07.072.
- (12) Benson RA, Nandhra S. Study protocol for COVID-19 Vascular sERvice (COVER) study: the impact of the COVID-19 pandemic on the provision, practice and outcomes of vascular surgery. *PLoS One* 2020;15:1–11 <http://dx.doi.org/>. doi:10.1371/journal.pone.0243299.
- (13) Sena G, Gallelli G. An increased severity of peripheral arterial disease in the COVID-19 era. *J Vasc Surg* 2020;72:758. doi:10.1016/j.jvs.2020.04.489.
- (14) Jongkind V, Earnshaw JJ, Gonçalves FB, et al. Update of the European Society for Vascular Surgery (ESVS) 2020 Clinical Practice Guidelines on the Management of Acute Limb Ischaemia in light of the COVID-19 pandemic, based on a scoping review of the literature. *Eur J Vasc Endovasc Surg* 2021. doi:10.1016/j.ejvs.2021.08.028.