

Vascular Care Delivery in COVID-19 Pandemic: Impact Use of an Office-Based Laboratory and an Ambulatory Surgery Center

Vascular Care Delivery Reduced the Risk of COVID-19 Transmission and Resource Utilization During the COVID-19 Pandemic

Abstract

Introduction: On March 20, 2020, the American College of Surgeons (ACS) released guidelines recommending the curtailment of elective surgical procedures in response to the coronavirus disease (COVID-19) pandemic. We immediately implemented these guidelines in our vascular surgery practice. The aim of this study was to compare the characteristics of surgeries performed in our practice in the 6-week periods before (Period 1) and after (Period 2) the release of the ACS guidelines.

Methods: The records of patients who underwent Vascular-vascular procedures performed by our group during the 126-week study period before COVID-19 restrictions (Group 1) and in the first 6-week period during the COVID-19 restrictions (Group 2) were reviewed. The number of procedures performed were facility type was categorized classified as hospital inpatient (HIP), hospital outpatient (HOP), office-based laboratory (OBL), ambulatory surgery center (ASC), and vein center (VC). The procedures type were also grouped was classified as: aneurysm (AAA), carotid (CAR), peripheral arterial disease (PAD), amputation/wound care (AMP), vascular access (VA), deep vein thrombosis (DVT), or chronic venous insufficiencyreflux (CVI). The number of healthcare provider contacts points for each per patient undergoing care procedures at in the HOP, OBL, and ASC was were also collected and compared between groups the periods 1 and 2. The significance of Differences differences between groups the periods were was determined using the two-way analysis of variance ANOVA.-

Results: There were no statistically significant differences between groups 1 and 2 for The procedure location or facility and procedure types did not differ significantly by period ($P = .xxx$ and $P = .yyy$, respectively) of procedure ($p > 0.05$). Patients who received ambulatory care, Patient the number of contacts with healthcare providers was significantly lower during Period 2 than during Period 1 (mean/median: [x] versus [y]; $P = .0xx$) decreased between groups 1 and 2 for ambulatory care. However, projecting During Period 2, the mean/median number of provider contacts per patient was significantly higher among those who received for patients in group 2 if they had to have ambulatory care in the HOP (11) setting (913) compared to contacts than in among those who received care in the OBL (4) and ASC (6; $P = .0xx$) setting (588) was statistically significant ($p < 0.05$). No healthcare-associated cases of COVID-19 were reported among patients or staff member at in the OBL or ASC during Period 2 developed COVID-19 infection because of the care received at these venues.-

Conclusion: During the height of the COVID-19 pandemic, The ability to provide provision of essential vascular care for to ambulatory patients in an ambulatory environment was enhanced by using our the OBL and ASC to limit their contact with healthcare workers, without compromising safety or adversely affecting the outcomes, efficacy, transmission of the virus to patients or staff during the height of the COVID-19 pandemic and limited their contact with healthcare workers and therefore reduced the consumption of personal protective equipment by healthcare personnel.

1. Introduction

This study aims to evaluate how access to an OBL and ASC has affected the ability of a vascular surgery group to provide essential vascular care during COVID-19. Institutional review board-

approval was waived as no patient-specific data was used in this submission. Retrospective review was conducted on the number and type of vascular procedures performed by our group between 3 February 2020 and 30 April 2020. The procedures were divided into two 6-week periods based on releasing the ACS guidelines, which our group immediately adopted. Group 1 included cases performed between 3 February 2020 and 20 March 2020, the 6-week period immediately prior to the guidelines' release and adoption. Group 2 included cases performed between 21 March 2020 and 30 April 2020, the 6-week period during the early surge of the pandemic and immediately following the release and adoption of the guidelines. Group 2 was limited to those deemed essential to the care and survival of the patient.

The Coronavirus Disease 2019 (coronavirus disease [COVID-19]) pandemic has had a devastating effect on global health and placed an unprecedented strain on the availability of healthcare resources^[1, 2]. With guidelines from the American College of Surgeons (ACS) recommending the cessation of all elective surgical procedures, the pandemic provided an unprecedented ability to challenge the healthcare systems to effectively care for patients while maintaining financial infrastructure has been challenged in ways not previously seen. Global initiatives, such as social distancing and sheltering-in-place have been were mandated at during different periods to help curtail the very real possibility of prevent the healthcare systems being from becoming overwhelmed by COVID-19. In addition, at the peak of the pandemic, surgical tiers of case urgency have also been were implemented to adequately allocate adequate resources and personal protective equipment (PPE) according to the greatest need, while preserving standards of patient care^[4]. The impact effect of these restrictions has created posed a significant major challenge on vascular surgery practices to adapt, with an unprecedented decrease in inpatient surgical case volume and a concomitant decrease in

the number of procedures performed in office-based laboratory (OBL) and ambulatory surgery center (ASC) facilities as well¹⁵.

On 20 March 20, 2020, the American College of Surgeons (ACS) published guidelines were published by the ACS regarding recommending the curtailment of all elective surgical procedures in response to the COVID-19 pandemic³. Our vascular surgery group implemented the ACS guidelines immediately during the early surge of the pandemic. All patients were screened prior to their surgery for possible COVID-19 symptoms and exposure and had their temperature measured before the start of their procedure. Positive Patients with positive screening result patients results had their procedure canceled or rescheduled pending further evaluation, according to published the guidelines.

This study aims aimed to evaluate document how access to an office-based laboratory (OBL) and an ambulatory surgery center (ASC has affected the ability of a) enabled our vascular surgery group to provide essential vascular care during the early stage of the COVID-19 pandemic

2. Materials and Methods

Study design and setting

Institutional review board approval was waived as no patient-specific data was used in this submission. We conducted a retrospective review was conducted on the number and type of vascular procedures performed by our vascular surgery group between 3 February 2020 and 30 April 2020. The procedures were study period was divided into two 6-week periods based on releasing the ACS guidelines, which our group immediately adopted. Group 1 included cases performed between 3 February 2020 before and 20 March 2020, the 6-week period immediately

prior to the guidelines' after the release and adoption. Group 2 included cases performed between 21 March 2020 and 30 April 2020, the 6-week period during the early surge of the pandemic and immediately following the release and adoption of the guidelines. Group ACS guidelines. Period 1 was from February 3 to March 20, 2020, and Period 2 was from March 21 to April 30, 2020. During Period 2 was, procedures were limited to those deemed essential to the patient care and survival of the patient.

Variables

On 20 March 2020, guidelines were published by the ACS regarding the curtailment of elective surgical procedures in response to the COVID-19 pandemic. For both groups, the The procedures were further categorized by the types of care facility in which the procedure was performed were grouped as. Categories included hospital inpatient (HIP), hospital outpatient (HOP), office-based lab (OBL), ambulatory surgery center (ASC), and vein center (VC). The Vascular cases procedures were also grouped by type of according to the procedure type, including as abdominal aortic aneurysmal disease (AAA), carotid artery disease (CAR), peripheral arterial disease (PAD), amputation/wound care (AMP), vascular access (VA), deep vein thrombosis (DVT), and chronic venous insufficiency (CVI). In our practice, Cases procedures performed predominantly performed in our the OBL include percutaneous peripheral angiography, interventions for lower extremity peripheral arterial disease PAD, and percutaneous interventions to maintain hemodialysis access fistulas and grafts. Procedures performed predominantly in the In our ASC, typical procedures performed by our vascular surgeons include placing chemotherapy-access ports for patients with cancer patients and creating arteriovenous fistulas and grafts for hemodialysis.

All patients were screened prior to their surgery for possible COVID-19 symptoms and exposure and had their temperature measured before the start of their procedure. Positive screening result patients had their procedure canceled or rescheduled pending further evaluation according to published guidelines.

The number of healthcare worker contacts per patient was also recorded ~~during these periods~~ for the different service sites-facility types in ~~the 2 groups~~ patients undergoing ambulatory care performed in HOP, OBL, and ASC facilities during the two periods.  These contacts included procedures done at the HOP, OBL, and ASC sites of service. A further comparison was made for In patients in who underwent procedures during the group Period 2, in this regard. The the observed and expected actual points-number of contacts in Group 2 were compared ~~with the~~ projected number of contacts for these based on the assumption that patients if all their ambulatory care ~~had to be~~ would be provided in the HOP rather than ~~setting in lieu of~~ the ASC and OBL. 

Differences between the results for Groups 1 and 2 were determined using the two-way ANOVA statistical method.  Contact tracing was performed for all Any patients or and providers in our practice who developed COVID-19 ~~infection~~ during the study period ~~of review~~ underwent contact tracing to determine ~~if their~~ whether the infection was due attributable to exposure as a consequence of our patient management strategy.

Ethical considerations

This retrospective review was approved by the Pima Heart and Vascular ~~research~~ Research ~~committee~~ Committee.  Owing to the retrospective ~~nature of the review~~ study design and the lack of use of patient identifiers, the requirement for informed consent was ~~waived~~ not required.

Statistical analysis

The statistical significance of differences between the results for Periods 1 and 2 were determined using two-way analysis of variance (ANOVA). Two-tailed P values less than .05 were considered statistically significant.

In the period of review, our group performed a total of 724 cases. From February 3 through March 20, group 1 comprised of 509 cases, while group 2 cases completed from March 21 through April 30 comprised of 215 cases. The overall volume of cases decreased by 58% due to COVID-19 restrictions.

3. Results

During the study period of review, our group performed a total of 724 cases. From February 3 through March 20, group 1 comprised of procedures, of which 509 cases, while group 2 cases completed from March 21 through April 30 comprised of procedures were performed during Period 1 and 215 cases were performed during Period 2. The overall volume of cases decreased by 58% due to COVID-19 restrictions.

during Period 2.

The distribution of the cases-procedures by type of facility type and period is shown in Figure 1. Of the 724 procedures performed during Period 1 Before the implementation of COVID-19 restrictions, 234 cases (46%) were performed in HIP, 66 cases (13%) were in HOP, 7 cases (1%) were in the ASC, 57 cases (11%) were in the OBL, and 145 cases (28%) were in the VC. Under COVID-19 restrictions Of the 215 procedures performed during Period 2, 130 cases (60%) were performed in HIP, 34 cases (16%) were in HOP, 9 cases (4%) were in the ASC, 40 cases (19%) were in the OBL, and 2 cases (1%) were in the VC. Two-way ANOVA shows no significant difference. The facility types did not differ significantly between the two periods groups 1 and 2 when comparing procedure sites.

The types of cases-procedures performed for during each time period are shown in Figure 2- appear in Figure 2. For group During Period 1, 16 cases (3%) were AAA, 15 cases (3%) were CAR, 21 cases (4%) were DVT, 84 cases (17%) were AMP, 93 cases (19%) were VA, 121 cases (24%) were PAD, and 145 cases (29%) were CVI procedures were performed. In During group Period 2, 4 cases (2%) were AAA, 10 cases (5%) were CAR, 13 cases (6%) were DVT, 48 cases (24%) were AMP, 61 cases (30%) were VA, 63 cases (31%) were PAD, and 2 (1%) cases were CVI procedures were performed. Although the number of Two-way ANOVA demonstrates no significant difference in the type of cases, though not unexpectedly, CVI procedures was lower during Period 2 than during Period 1 cases were most prominently affected by the COVID-19 restrictions as these types of procedure was cases were not considered nonessential, the overall distribution of procedure types did not differ significantly between the two periods.

Table 1 shows the types of touch points for each service site of HOP, OBL, and ASC to compare the The number of healthcare worker encounters-contacts per patient for among patients receiving ambulatory care in HOP, the OBL, or the ASC, is shown in Table I. HOP, a The patients had contact with encounters- a mean/median 1 healthcare workers in the HOP, during their stay for an outpatient procedure. For our OBL, a patient encounters 4 healthcare workers in the OBL, and during their stay for an outpatient procedure. Finally, for our ASC, a patient encounters 6 healthcare workers in the ASC during their stay for an the outpatient procedure.

Table 2 displayed the data comparing the The total number of healthcare worker contacts during Periods points for groups 1 and 2 for among patients who receiving received their care at in HOP, the OBL, and the ASC are shown in Table II. based on the number of ambulatory cases at each site of service for each group. A The third column in in Table 2 II provides the projected points- shows the expected number of contacts for patients in group Period 2 patients, assuming that the

OBL and ASC were not available for care and ~~that~~ all ~~the~~ ambulatory care was provided in the HOP ~~setting facility~~. The total number of patient-provider contacts ~~s points~~ for ~~the~~ outpatient care ~~we provided~~ was significantly ~~less-lower in patients treated when that care was provided~~ in the OBL and ASC than ~~in those treated in the HOP if that care had to be provided in a hospital-outpatient department~~. No ~~cases of COVID-19 were reported in patients treated in their provider developed COVID-19 infection due to treatment at our~~ OBL or ASC, ~~or in providers working in these facilities~~, during the study period.

4. Discussion

During the period of COVID-19 restrictions, ~~Our our~~ practice ~~expected-experienced~~ a decrease of 58% ~~decrease~~ in the ~~volume-number~~ of hospital-based ~~vascular~~ procedures ~~performed under COVID-19 restrictions~~. The distribution between types of ~~cases-procedures being~~ performed remained relatively ~~similar-unchanged~~ between the two ~~time~~ periods, except for AAA and CVI ~~cases-procedures~~. The precipitous drop in ~~the number of~~ CVI ~~cases-procedures is-was~~ expected as ~~in most cases~~ patients with ~~chronic venous insufficiency-CVI~~ can safely have their intervention deferred without ~~creating any significant undue~~ risk to the patient ~~in most cases~~. ~~While-Although~~ the presence of an AAA ~~confers-is associated with~~ an ~~increasing-increased~~ risk of rupture ~~with-if~~ treatment ~~is~~ delay~~ed~~, the requirement for inpatient admission ~~for-even~~ ~~for~~ endovascular repair of an ~~aortic aneurysm-AAA~~ results in ~~the-high~~ utilization of limited hospital resources. These cases were deferred unless the patient was experiencing aneurysm-related symptoms, or ~~if a delay was considered high-risk because of the large size of their aneurysm-was-considered-large-enough~~ ^{that} ~~delay would be too risky [8]~~.  strategy resulted in a decrease in ~~the number of surgeries for~~ AAA ~~cases-under during the period of~~ COVID-19 restrictions.

While ~~Although~~ there were no significant differences between location ~~the~~ or types of facility and procedure types did not differ significantly between for the two time periods, the proportion of procedures performed in the we did observe that OBL and ASC was higher during cases comprised a greater proportion of cases in the second time period Period 2 than that during Period 1 (23% and 12%, respectively), with such cases comprising only 12% of cases in group 1 and 23% of cases in group 2, reflecting a. This observation reflects the significant decrease in the volume of hospital-based procedures being performed by our practice under the statewide restrictions on elective procedures and with the implementation of surgical tiers pertaining to case urgency. The continued Continued access to both ASC and OBL venues during these times the period of COVID-19 restrictions judicious allocation of hospital resources provided enabled our group the ability to continue to provide essential patient-vascular care services to ambulatory patients during the COVID-19 pandemic in an ambulatory setting, effectively minimizing contact with healthcare workers, while conserving hospital PPE, and reducing the utilization of hospital resources.

Our findings also highlight the differences in the minimum number of healthcare worker critical contacts points required when patients receive that patients must make when being provided vascular care in the HOP, ASC, and OBL. As one can see, They reveal that hospital-based outpatient HOP services require more healthcare worker contacts per patient points that a patient must navigate, with each touch point contact conferring a risk of possible COVID-19 transmission either to the patient or to a the healthcare worker. The benefit of utilizing The use of the ASC and OBL for providing outpatient services is striking had a marked benefit. We found that t The number of patient contacts points was significantly less for patients receiving outpatient care in the OBL and ASC than would have been the case encountered if had that the same

~~procedure care been performed in the HOP facility was only available using hospital outpatient services.~~ A secondary and equally important ~~benefit of providing care in the OBL and ASC during observation in the context of the COVID-19 pandemic~~ was ~~is that each patient contact point requires the use of PPE by the healthcare worker. Similar to the drop in contact points appreciated by the use of the OBL and ASC, it follows that there would be a proportionately significant the associated~~ reduction in PPE ~~utilization-use~~ compared with providing the same care in the HOP facility ~~hospital outpatient venues.~~

Hashmi et al. ¹⁰  ~~viewed~~ the quality and characteristics of surgery and interventional radiology procedures during the COVID-19 pandemic at a tertiary center in the Midwest United States  ~~and~~ during the COVID-19 pandemic [10]. They investigators observed that ~~while-although~~ all case volumes decreased, the ~~degree-to-which extent of the decrease in~~ surgical subspecialty ~~procedural-procedure~~ volume ~~decreased-outpaced-exceeded that of~~ the decrease ~~of-in~~ interventional radiology ~~procedural-procedure~~ volume. This was attributed to the ~~fact that~~  ~~each~~ higher proportion of surgical procedures that required general anesthesia, ~~to-perform-and~~ thus incurring ~~the-a~~ risk of aerosol generation ~~from-during~~ intubation. In line Consistent with this observation, our study ~~observed-revealed~~ an increased proportion of vascular surgery procedures being performed in the ASC or OBL settings facilities, where ~~eases-procedures~~ performed for urgent and semi-urgent indications, such as critical limb ischemia or dialysis maintenance, can be performed utilizing-using local anesthesia or minimal sedation.

This study has some limitations. 

~~We believe that with the institution of methodical and rigorous screening measures, and while-widespread immunization with the COVID-19 vaccine is implemented, essential care can-continue to be safely provided for vascular surgery patients in the ambulatory setting, such as an-~~

ASC or OBL. Furthermore, in the context of the COVID-19 pandemic, we believe that essential care in the ambulatory setting, when available, is the superior option in comparison to similar care provided in the hospital setting. This is due to the decreased touch points inherent to care provided in the ambulatory setting as well as the reduction of hospital resource utilization at a time when they are already stretched thin. 

5. Conclusions

Our This retrospective study evaluated the impact effect of utilization of the COVID-19 restrictions on the use of ASC and OBL venues facilities for providing essential vascular care in an ambulatory patients in a single vascular surgery group environment during the early phase of the COVID-19 pandemic for a single vascular surgery group. We believe that with the institution of Implementing methodical and rigorous screening measures, and while widespread immunization with the COVID-19 vaccine is implemented, enables the provision of essential care can continue to be safely provided for vascular surgery services to ambulatory patients in the ambulatory setting outpatient facilities, such as an ASC or OBL; while COVID-19 vaccination is being implemented.  Furthermore, in the context of during the COVID-19 pandemic, we believe that providing essential care in the ambulatory an outpatient setting, when available, is the superior option in comparison preferable to providing similar care provided in the hospital setting. This is due owing to the decreased touch points inherent to care provided in the ambulatory setting as well as number of contacts between patients and healthcare providers and the reduction of hospital resource utilization at during a timeperiod when they resources are already stretched thin.

limited.

Acknowledgments

References

1. Sohrabi, C.; Alsafi, Z.; O'Neill, N.; Khan, M.; Kerwan, A.; Al-Jabir, A.; Iosifidis, C.; Agha, R. World Health Organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19). *Int. J. Surg.* 2020, 76, 71–76.
2. COVIDSurg Collaborative. Elective surgery cancellations due to the COVID-19 pandemic: Global predictive modelling to inform surgical recovery plans. *Br. J. Surg.* 2020, 107, 1440–1449.
3. American College of Surgeons. COVID-19: Recommendations for Management of Elective Surgical Procedures. Available online: <https://www.healio.com/news/orthopedics/20200316/american-college-of-surgeons-provides-recommendations-for-elective-surgery-during-covid19-pandemic> (accessed on 18 December 2020).
4. Ross, S.W.; Lauer, C.W.; Miles, W.S.; Green, J.M.; Christmas, A.B.; May, A.K.; Matthews, B.D. Maximizing the calm before the storm: Tiered surgical response plan for novel coronavirus (COVID-19). *J. Am. Coll. Surg.* 2020, 230, 1080–1091.e3.
5. Mirza, A.K.; 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.

6. Kirksey, L.; Droz, N.M.; Vacharajani, T.; McLennan, G.; Clair, D.G.; Lyden, S.P. COVID era “essential surgery” dialysis access management considerations. *J. Vasc. Surg.* 2020, 72, 1845–1849.
7. Cohen, L.M.; Ruthazer, R.; Moss, A.H.; Germain, M.J. Predicting six-month mortality for patients who are on maintenance hemodialysis. *Clin. J. Am. Soc. Nephrol.* 2010, 5, 72–79.
8. Oliver-Williams, C.; Sweeting, M.J.; Jacomelli, J.; Summers, L.; Stevenson, A.; Lees, T.; Earnshaw, J.J. Safety of Men with Small and Medium Abdominal Aortic Aneurysms Under Surveillance in the NAAASP. *Circulation* 2019, 139, 1371–1380.
9. Pini, R.; Faggioli, G.; Vacirca, A.; Gallitto, E.; Mascoli, C.; Attard, L.; Viale, P.; Gargiulo, M. Is it possible to safely maintain a regular vascular practice during the COVID-19 pandemic? *Eur. J. Vasc. Endovasc. Surg.* 2020, 60, 127–134.
10. Hashmi, A.; Parikh, K.; Al-Natour, M.; Azar, N.; Sutter, C.; Ramaiya, N.; Davidson, J.; Tavri, S. Interventional radiology procedural volume changes during COVID-19 initial phase: A tertiary level Midwest health system experience. *J. Clin. Imaging* 2021, 72, 31–36.