
Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

ELSEVIER

# Optimizing Best Vascular Access Practice in Patients on Dialysis during the COVID-19 Pandemic Period

*Dear Editor*

The COVID-19 crisis has opened the Pandora's box of interconnected challenges where, vascular access (VA) and renal physicians must confront with and adapt to deliver the maximum desired health care service for their patients on dialysis. Raising the bar for quality means that high surgical and endovascular standards are becoming the cornerstone of treatment option and dedicated experienced medical staff is the sine qua non for achieving this goal. An operative team checklist should be developed to accomplish maximum safety with optimal results coupled with larger patient volume and a rapid turnover, at the same time focusing on reducing the potential risk of COVID-19 transmission.

The recommendations recently proposed by the European and American Vascular Societies in this new ''COVID-19'' era, regarding the deferral of VA creation in incident predialysis patients, or revision for VA malfunction/steal in prevalent dialysis patients aims to protect them, the medical staff, and the community from uncontrolled spread of the virus and consequently from possible avoidable mortality.[1,2] Fortunately, the coronavirus pandemic will not last forever, and even though there will be a second intense wave of the epidemic in some countries, many things will, and must change, after the quarantine is permanently lifted, especially the safely care of high-risk patients, like those on maintenance hemodialysis. However, this global pandemic crisis really unmasked the general rule that if these potentially noninfected hemodialysis patients are handled appropriately, by dialysis clinicians and VA surgeon teams, this can be turned into a high opportunity to avoid COVID-19 infection. We will describe in this letter our strategies and proposals for optimum VA surgery results in the pandemic period establishing the lowest risk of COVID-19 transmission.

## THE NEED OF DEDICATED VASCULAR ACCESS CARE

Clinicians know that the infectivity of this virus is high in this cohort, not only due to immunosuppression and increased comorbidity,[3] but also due to disproportional great burden of infectious risk factors at regular lifesaving dialysis sessions.[4] Furthermore, patients receiving maintenance hemodialysis are more susceptible to COVID-19 and hemodialysis centers are high-risk settings, as confirmed in a recently published article from Wuhan, China.[5] As such, a shift of patients to less frequent hemodialysis schedules (twice-weekly) has been proposed, an option that would likely provide adequate control of uremia, at least over a matter of weeks and also proved beneficial for the patients and staff, providing less exposure to potential COVID-19 infection.[6] On the other hand, dialysis-dependent patients, acknowledging their high vulnerability because of their chronic illness, are worried that patient clustering during dialysis in large medical centers or private facilities could expose them to viral transmission from asymptomatic people having the disease, thus becoming future outbreaks. Notably, we were witnessing negative responses to this pandemic, from hemodialysis patients, that we have never seen before. Patients are refusing to receive declotting of thrombosed arteriovenous grafts, correction of large access-related pseudoaneurysms (Fig. 1), or even transplantation that was expected for several months! In addition, we experienced patients even refusing treatment for foot gangrene attributed to severe peripheral arterial disease due to anxiety of a prolonged hospital stay! This reluctance for salvaging VA, for example, comes from the fear of acquiring COVID-19 infection because residents in every country receiving maintenance dialysis treatment belong to one of the most vulnerable subpopulations in medical practice. Surprisingly, in many occasions, this hesitation overcomes the benefit of establishing a well-functioning fistula or graft!

In this regard, all VA surgeons must give priority in altering modifiable factors of different aspects of VA care of these patients, leading to the lower hospitalization rates with optimum results. Both nephrologists and VA surgeons have to persuade them that the delivery of health care will be safe and of the best quality even in this global human threat period. Although several COVID-19-related organizational models for the protection of patients with renal disease and staff have been described in many dialysis units,[7] clinical choices and operational strategies guided to VA creation and maintenance are lacking. Recent universal recommendations state that operations on patients with confirmed or suspected COVID-19 infection must be carried out in a designated room with necessary protection for medical staff.[8] This of course contributes to the big challenge of epidemic control, but VA issues still remain unresolved, while re-establishing confidence between patients and health care workers is urgently required. The following are some of the critical points, nondialysis facilities related, but VA related, in mitigating the risk of COVID-19 spread and keeping VA complications to a minimum.

*Disclosure statement: The authors declare no competing interests.*
*Funding sources: No funding relevant to this study.*

*Ann Vasc Surg 2021; 70: 302–305*
*https://doi.org/10.1016/j.avsg.2020.08.100*

*Published online: 29 August 2020*

## THE ''SURGEON AND CENTER EFFECT'' PHENOMENON

Starting from the impact of surgeon's experience, substantial variations in outcomes of VA surgery exist between countries,[9] suggesting that in countries with high COVID-19 contamination burden, such as Italy, Spain, the UK, and the USA, for example, a focus on the ''surgeon effect''[10] in the pandemic period could result in better fistula outcomes from the best qualified VA surgeons. Furthermore, a study from the Netherlands showed that the probability of primary failure is strongly related to the center of access creation, suggesting an important role for the vascular surgeon's skills and decisions, apart from the similarly important role of the caring nephrologists. More specific, the primary fistula failure rate, varied from 8% to 50% among 11 centers, and when adjusted for potential risk factors and for surgery-related factors, some centers had 5.5- to 9.4-fold lower performances than the reference ones,[11] suggesting that the ''center effect'' phenomenon is also countable even within the same country or region. Translating this to a ''global effect'' phenomenon, in which great differences in the distribution of VA use by country (Dialysis Outcomes and Practice Patterns Study [DOPPS] data) exist, nations with high prevalence of fistulas, such as China, Germany, and the UK (87%, 80%, and 80%, respectively)[12] must regulate their strategies tailoring every complicated case to the most qualified VA surgeons with the best judgment and techniques. This modified strategy will keep known and unjust disparities in health care of patients with end-stage renal disease, which generally represent institutional or provider biases, to a minimum. In real-world conditions, identification of centers of VA excellence and/or experienced VA physicians is a composite and multifactorial process. However, physician-centered quality indicators, self-reported VA preference surveys, and patient questionnaires could indicate the continuing efforts by dialysis units to optimize VA use for their patients. The adjustment of each national health care system to the local aspects involved in increasing AVF functionality through monitoring and optimizing VA surgery should be able to improve VA outcomes, leading to the ''surgeon and center effect'' phenomenon. As a surgical tactic, this is more important in countries with the highest threat by the coronavirus pandemic, which should assess their available VA surgeon capacity and match this to the dialysis-dependent patient's needs, keeping their complications to a minimum. Developed operative teams should be able to accomplish maximum safety with optimal results coupled with rapid turnover.

Taking the responsibility of this proposal, in our view, only vascular surgeons and a few expert nephrologists should be involved in the care of patients on dialysis[13] in the pandemic period, especially those performing increased rate of complex procedures. It is reasonable for everyone to assume that surgical trainees should not be involved, considering the reduced likelihood of fistula use reported in a previous DOPPS study, when performed by uncertified and not qualified residents,[14] leading to readmissions for a new VA, for fistula thrombosis episodes or prolongation of central venous catheter (CVC) use. In another DOPPS, the risk of primary fistula failure was 34% lower when created by surgeons who exceeded the threshold of 25 fistulas during training (relative risk, 0.66; $P = 0.002$).[15] Furthermore, increased surgeon training in fistula placement was associated with a greater likelihood of fistula versus graft placement, with an adjusted odds ratio of 2.2 for fistula placement for each 2-fold−higher number of fistulas created during training ($P = 0.0001$).[15] Apart from first-time fistulas in incident or prevalent CVC patients, expeditious but effective VA surgery requires that time and type of access, complicated redo operations salvaging failing, or managing failed fistulas are beyond the technical surgical performance of trainees and less experienced VA surgeons, potentially leading to suboptimal results.[16] Taking in aggregate, a low ''failure to save'' index (defined as the number of abandoned fistulas divided by the number of failing/failed and nonmatured ones within 6 weeks from creation) obtained in the pandemic period is the mirror of high performance quality in VA surgery because this index is less sensitive to patient-related factors than hospital/surgeon performances.[17]

Besides VA saving issues, the meticulous planning and process of ''proper VA selection'' are fundamental to avoid type of accesses that will eventually not fulfill the needs of the patient's dialysis prescription leading to more future interventions[18] undesirable in this pandemic period. Until studies are able to predict which patients will likely have fistulas that will mature but also require procedures to assist maturation and patency, a more thoughtful approach to VA selection is required during the ongoing COVID-19 outbreak. Considering all the aforementioned, and ensuring the best VA team and procedure, VA creation and revision will become a priority even in the pandemic era. Delivering on that promise to patients and nephrologists resides to the more smooth transition from a ''VA lockdown'' to VA establishing practices.

## HIGH SURGICAL AND ENDOVASCULAR VASCULAR ACCESS STANDARDS

Managing surgical and endovascular workload during a protracted COVID-19 outbreak also involves searching for innovative solutions.[19] Therefore, a great proportion of fistula creation or reconstruction should be switched toward minimally invasive strategies, preferably percutaneous, in both the elective and emergency setting. Maintenance percutaneous transluminal angioplasty reduces the thrombosis rate and associated hospitalization, CVC placement, and missed dialysis sessions, suggesting that despite financial implications, dedicated endovascular fistula salvage solutions from experienced interventionalists[20] should be highly incorporated in this

**Fig. 1.** A 14-year-old girl from Somalia, living in a refugees camp in Greece, was admitted in an emergency basis in our hospital, suffering from a large pseudoaneurysm in a brachial-cephalic fistula (primary patency ~4 years), with impending rupture. For the fear of COVID-19 infection, her mother initially refused hospitalization for vascular access revision.

pandemic period practice. End events such as fistula thrombosis, could be catastrophic, especially if the CVC has a lengthy course, mainly from patient reluctance to receive any hospitalization and interventional therapy serving as potential vectors for coronavirus infection. As such, countries with already high rates of CVCs in incident patients, such as the USA, will probably have a major problem in this critical period because CVCs are the dominant driver of morbidity and mortality.[21] However, if a CVC placement is unavoidable, placement should be performed in an isolation suite with the use of a portable ultrasound and C-arm. Even though current practice patterns may not align with patient interests, mismatches in patient eligibility for fistula rather than graft should be kept to a minimum to avoid many prematuration and postmaturation interventions contributing to shorter periods of ''complication free fistula use.''

Special vaccine for COVID-19 disease is not yet available, but until then, we will face many necessary readmissions for VA complications considering that a typical VA intervention rate is approximately 1.9 per patient per year. Thus, the perfect current hospital environment, we need now, is one that requires short hospitalization period, the least possible morbidity rates, and the one-shot solution to the problem.[9] However, the lack of in-hospital beds and alterations in nursery staff might change the whole availability organization at some hospitals, serving as the key factor in surgical decision-making in some cases in favor of urgent or semiurgent surgical care alone.[22] Following these, our goals should be tailored to attain a reliable dialysis access for each patient[18] in one operating theater visit session. Failure to obtain these needs will eventually lead to patients but also nephrologists to dissatisfaction. Last but not least, efficient cannulation techniques, preferably under ultrasound guidance,[23] are highly dependent on the level of expertise of the dialysis unit medical and nursing staff, representing a barrier to dialysis unit complications avoiding further patient dissatisfaction when successful.

Definitely, the COVID-19 crisis has opened the Pandora's box of interconnected challenges where VA surgeons must confront with and adapt to deliver the maximum desired health care service for patients on dialysis. Raising the bar for quality means that high surgical and minimally invasive endovascular standards are becoming the cornerstone of treatment option and dedicated experienced medical staff is the sine qua non for achieving this goal.

As a conclusion, uremic patients on dialysis needing VA care should not influenced by the pandemic issue and should be motivated by our growing abilities to develop personalized treatments for every acute and chronic VA complications. Although nephrologists cannot modify VA disease presentation, continuity of follow-up and their updated clinical information to patients on dialysis is the key to success. Furthermore, the suitability of therapeutic approaches when urgently needed should be addressed by an experienced and qualified VA surgeon and center, with the lowest COVID-19 contamination risk. Like all vascular patients, patients on dialysis must not become collateral damage of COVID-19.[24] Managing our abilities to this susceptible population, patients on dialysis could overcome their reluctance to any surgical or interventional procedure, a fact that poses risks to their general health. Moving forward, by achieving these alliances, nephrologists and VA surgeons could reach out, even more actively, to the broad array of VA problems promoting the health of patients on dialysis (see Fig. 1).

*George S. Georgiadis*
*Christos Argyriou*
*Department of Vascular Surgery*
*Medical Faculty*
*''Democritus'' University of Thrace*
*Alexandroupolis, Greece*

*Konstantia Kantartzi*
*Department of Nephrology*
*Medical Faculty*
*''Democritus'' University of Thrace*
*Alexandroupolis, Greece*

*Vasileios Souftas*
*Department of Interventional Radiology and Medical Imaging*
*Medical Faculty*

*''Democritus'' University of Thrace*
*Alexandroupolis, Greece*

*Miltos K. Lazarides*
*Department of Vascular Surgery*
*Medical Faculty*
*''Democritus'' University of Thrace*
*Alexandroupolis, Greece*
*E-mails: ggeorgia@med.duth.gr or georgiadis.vasc@gmail.com*

## REFERENCES

1. https://vascularnews.com/vascular-society-issues-guidance-on-covid-19-and-vascular-surgery/. Accessed June 5, 2020.
2. https://www.facs.org/covid-19/clinical-guidance/elective-case/vascular-surgery. Accessed June 5, 2020.
3. Kliger AS, Silberzweig J. Mitigating risk of COVID-19 in dialysis facilities. Clin J Am Soc Nephrol 2020;15:707–9.
4. Ikizler TA, Kliger AS. Minimizing the risk of COVID-19 among patients on dialysis. Nat Rev Nephrol 2020;6:1–3.
5. Xiong F, Tang H, Liu L, et al. Clinical Characteristics of and medical interventions for COVID-19 in hemodialysis patients in Wuhan, China. *J Am Soc Nephrol* 2020;31:1387–97.
6. Meyer TW, Hostetter TH, Watnick S. Twice-weekly hemodialysis is an option for many patients in times of dialysis Unit stress. *J Am Soc Nephrol* 2020;31:1141–2.
7. Esposito P, Russo R, Conti N, et al. Management of COVID-19 in hemodialysis patients: the Genoa Experience. *Hemodial Int* 2020;24:423–7.
8. Basile C, Combe C, Pizzarelli F, et al. Recommendations for the prevention, mitigation and containment of the emerging SARS-CoV-2 (COVID-19) pandemic in haemodialysis centres. Nephrol Dial Transpl 2020;35:737–41.
9. Fila B, Roca-Tey R, Malik J, et al. Quality assessment of vascular access procedures for hemodialysis: a position paper of the Vascular Access Society based on the analysis of existing guidelines. J Vasc Access 2020;21:148–53.
10. Spergel LM. Surgery and AVF immaturity: what matters most? Surgical judgment and technique are most important (The eleventh annual controversies in dialysis access). J Vasc Access 2014;15:S23.
11. Huijbregts HJ, Bots ML, Moll FL, et al. Hospital specific aspects predominantly determine primary failure of hemodialysis arteriovenous fistulas. J Vasc Surg 2007;45:962–7.
12. Pisoni RL, Zepel L, Port FK, et al. Trends in US vascular access use, patient preferences, and related practices: an update from the US DOPPS practice monitor with international comparisons. Am J Kidney Dis 2015;65:905–15.
13. Georgiadis GS, Kantartzi K, Argyriou C. Complex revision operations should be performed only by vascular surgeons and a few expert nephrologists. J Vasc Access 2017;18:e6–7.
14. Pisoni RL, Young EW, Dykstra DM, et al. Vascular access use in Europe and the United States: results from the DOPPS. Kidney Int 2002;61:305–16.
15. Goodkin DA, Pisoni RL, Locatelli F, et al. Hemodialysis vascular access training and practices are key to improved access outcomes. Am J Kidney Dis 2010;56:1032–42.
16. Lazarides MK, Georgiadis GS, Georgakarakos EI. What is the best training for vascular access surgery? J Vasc Access 2015;16:S16–9.
17. Lazarides MK, Baktiroglu S, Georgiadis GS. Failure to save (FTS): a proposed new index of performance quality in access surgery. J Vasc Access 2020;21:399.
18. Lok CE. Fistula interventions: less is more. J Am Soc Nephrol 2019;30:2040–2.
19. Quek LHH, Tan GWL, Pua U. Managing endovascular workload during COVID-19 outbreak-the Singapore experience. Ann Vasc Surg 2020;66:3–5.
20. Trerotola SO, Saad TF, Roy-Chaudhury P, et al. The Lutonix AV Randomized Trial of Paclitaxel-Coated Balloons in arteriovenous fistula Stenosis: 2-year results and Subgroup Analysis. J Vasc Interv Radiol 2020;31:1–14.e5.
21. Foley RN, Hakim RM. Why is the mortality of dialysis patients in the United States much higher than the rest of the world? J Am Soc Nephrol 2009;20:1432–535.
22. Reyes Valdivia A, Aracil Sanus E, Duque Santos Á, et al. Adapting vascular surgery practice to the current COVID-19 era at a Tertiary Academic center in Madrid [published online ahead of print, Jun 4, 2020]. *Ann Vasc Surg* 2020;67:1–5.
23. Scoppettuolo G, Biasucci DG, Pittiruti M. Vascular access in COVID-19 patients: Smart decisions for maximal safety [published online ahead of print May 5, 2020]. *J Vasc Access* 2020;21:408–10.
24. Precup CG, Bordet M, Lermusiaux P, et al. Thinking beyond the box: Preparing for the end of COVID-19 outbreak in a vascular surgery Department. Ann Vasc Surg 2020;66:1–2.