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Cardiovascular disease and surgery amid COVID-19 pandemic

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At the close of 2019, the World Health Organization offices located in China reported an outbreak of pneumonia of unknown cause, detected in the city of Wuhan in the Hubei Province.[1] Reports had summarized it as a group of affected patients who were vendors or dealers at the local Huanan Seafood market. Hence, the World Health Organization initiated a strategic process to identify and find the affected individuals and report on their early assessment. Since then, the infectivity, virulence, and spread of this, initially unknown but later identified through genomic sequencing, microorganism have been unprecedented.[2-5]

The devastation and transmission throughout different parts of the world have been unprecedented. Fatalities have been increasing worldwide, and most affected areas have shifted since the start of the outbreak. The UK government initiated stringent strategies and lockdown to halt the spread of this virus.[6,7] However, it is too early to decide whether the measures instigated have been effective.

European nations have been inflicted with the devastation caused by COVID-19, similar to China and Southeast Asia. The UK's healthcare system has been battling to restrain, not only the extent of the virulence of this virus, but also the case fatalities and negative outcomes. The reports have been unsettling, the effectiveness of government lockdown is uncertain—the future is uncertain. However, one point is certain, backlashes and staggering results have been increasing.

Our knowledge of COVID-19 is still evolving rapidly, and the present review has discussed the healthcare effects sieved from the whole spectrum of this pandemic, focusing on vascular disease and surgery, implications on healthcare economics, strategic assessments, and future outlooks for this prevailing situation. In our review, we have reflected on the limited measures taken to halt the progression of the disease within the healthcare sector and the potential effects this virus might have in the future.

It is imperative to identify those patients more likely to develop complications should they become infected with COVID-19. Included in the high-risk patient group are the elderly, the immunocompromised, those with ischemic heart disease, men, and smokers. These groups appear to be at greater risk of infection and the consequences of infection.[8,9] However, although these characteristics are among the demographic characteristics that are features pertinent to patients with vascular issues who we treat on a daily basis,[10] COVID-19 has an indubitable effect that can be superimposed on cardiovascular patients per se and on the conduct of service operations and performance. One strong feature that can be culpable for destabilizing the cardiovascular—COVID-19—infected population is the potential acceleration in inorganic calcium deposit destabilization, leading to myocardial infarction, myocarditis, and heart failure. Another superimposed factor that can change the outcomes of the patients we treat on a daily basis[10] is the virulence of this virus, which is mainly concentrated in the respiratory tract. However, it is imperative to note that this concentration in the respiratory tract can cause a superimposed bacterial infection that could compound the presentation of such patients and affect the potential outcomes.[11,12] Moreover, bacterial infection can incite graft infection, hinder wound healing, and compromise pulmonary gas exchange. This surely has direct or indirect effects on healing mechanisms and potentiates other pertinent clinical scenarios. In addition, antibiotics stewardship and the principles of "Start Smart Then Focus" would not be applicable in such scenarios. Hence, a tailored approach toward individual patients is the best strategy. We must determine our priorities, while keeping COVID-19 in the background per se, and focus on the prioritization of therapy according to each patient's individual need. This is of paramount importance. However, the presence of occult bacterial infections could be overlooked when all our attention is focused on COVID-19.

Although COVID-19 is a viral infection, clinical and radiologic features and scenarios overlap with those of bacterial respiratory tract infection. Hence, it is prudent and inevitable that antibiotics will be prescribed for many patients regardless. No therapies for COVID-19 have yet

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been approved, and scattered unsolicited trials have informed our current understanding of how to treat COVID-19. Hence, the choice of prescribing antibiotics to those patients with known comorbidities cannot be excluded (eg, chronic obstructive pulmonary disease exacerbations with purulent sputum or radiologic evidence of pneumonia). However, it imperative to realize that a tailored decision-making process regarding the laboratory evaluation might not be sensitive to COVID-19; thus navigating the unknown terrain of COVID-19 is a challenge. In addition, the analyses of the demographic, clinical, laboratory, and radiologic differences between patients who were and were not admitted to the intensive care unit have not yet provided conclusive findings for our cohort of patients.

No study has yet delineated the structural changes that coronavirus might have in our population of patients nor is it known whether any will be possible in the future. Such studies will have limited resources, and the numbers of patients will be relatively small and, we infer, will not be able to provide substantial findings for current and future generations.

In addition, data on the clinical characteristics of the patients who have died are scarce. No vaccine or specific antiviral treatment for COVID-19 has yet been shown to be effective; thus, supportive therapy is provided to ameliorate the symptoms, and protection of multiorgan function is crucial in this rapidly evolving climate.[13]

A recent study of the clinical characteristics of 113 deceased patients with COVID-19 outlined the clinical results related to COVID-19 and reported that patients with cardiovascular comorbidity were more likely to develop cardiac complications.[14] However, of the history of cardiovascular disease, acute cardiac injury and heart failure were more common in the patients who had died. That study was limited because it had included only patients who had died and almost all these patients had been classified as severely or critically ill and without having been risk stratified. Nevertheless, the high incidence of cardiovascular events in their cohort suggests that earlier monitoring and cardiovascular supportive care are of paramount importance to avoiding the death of these patients. Focused studies are necessary to provide specific evidence for appropriate decision-making in our population.

OPERATIONAL MANAGEMENT AND PERFORMANCE

The truth to the matter is that we are unable to yet comprehend the scale of this effect on the health sector, to say the least. The reduction in taskforce due to COVID lockdown and social isolation has impacted the running of financial output precisely.

COVID-19 has resulted in evolving operational measures to keep physicians from our specialty, whether treating cardiovascular patients or deployed to treat other patients, in line with the guidelines issued through Public Health England for National Health Service workers and practitioners. These guidelines were planned at the national level, and differences were included to allow healthcare workers to meet the challenges at different healthcare sites. Overall, changes have already been introduced as follows:

1. The provision of adequate staffing and capacity to care for patients
2. Routine face-to-face appointments between patients and the vascular team have been suspended, with patients meeting with healthcare providers by telephone or using digital technology where available; thus, patients still requiring an in-person appointment can still receive treatment as a priority
3. Nonemergency, planned "elective" surgery at hospitals has been postponed, and visiting and access arrangements have been adapted to ensure safety is paramount
4. Deployment of vascular juniors with different skill sets has been allowed, if necessary, to support care in the intensive care unit setting and emergency admissions
5. Extension of patient beds into vascular theaters and/or operating rooms to allow space for the increasing number of critical admissions, with most ventilatory support equipment required for the admitted case load

These measures and changes in performance to meet the challenges and demand on healthcare provision will have additional effects. The limitation of hospital operating rooms and theaters to only emergency cases will inflate the scale of future elective procedures. This, in turn, could result in a progressive increase in emergency care as an immediate effect. The scale of this conversion will result in extra duties for teams already exhausted from the COVID-2019 pandemic, who will struggle to meet the demands in the face of changes in service configurations, rerouting and prioritization of emerging cases, and increased pressure on existing services. These factors will be compounded in our specialty, which is in dire need of an increased taskforce. This will further burden any cost-effective protocols in place such as in radiology, and other surgical disciplines, which would likely follow suit, including orthopedics, general surgery, and oncologic surgery. Indirectly, downstream effects could occur in life expectancy, which would affect the modeling produced by different public health departments, and our ability to generate responses will be very important for economic efficiency.

Surgeons in training have keys roles to play during the COVID-19 pandemic. However, their emergency deployment to other sectors and frontlines has affected the quality and quantity of their training. Hence, from a monetary perspective, this would transform their working

times and training to service provision that could have implications on learning and clinical development. Consequentially regulatory bodies may be under pressure to address these potential concerns. For many of these elements, it is difficult to predict how a specific power would be used in a specific context; therefore, the monetized costs are difficult to assess and evaluate until the cloud has dispersed.

CONCLUSIONS

The fight against COVID-19 and its spectral and elusive outcomes has not yet finished. The inclusive totality of the repercussions on our patients will be delineated in the immediate future in the post-COVID-10 era. What is certain is that the quality of the service provisions to patients will be affected at a multitude of levels. The pertinent objectives are to save as many as possible and to save ourselves to live in the restructuring phase and the aftermath.

REFERENCES

1. Gorbalenya AE, Baker SC, Baric RS, de Groot RJ, Drosten C, Gulyaeva AA, et al. Severe acute respiratory syndrome-related coronavirus: the species and its viruses—a statement of the Coronavirus Study Group [published online ahead of print February 11, 2020]. bioRxiv doi: 10.1038/s41564-020-0695-z.
2. Jin Y, Yang H, Ji W, Wu W, Chen S, Zhang W, et al. Virology, epidemiology, pathogenesis, and control of COVID-19. Viruses 2020;12:E372.
3. Petrosillo N, Viceconte G, Ergonul O, Ippolito G, Petersen E. COVID-19, SARS and MERS: are they closely related? Clin Microbiol Infect 2020;26:729-34.
4. Backer JA, Klinkenberg D, Wallinga J. Incubation period of 2019 novel coronavirus (2019-nCoV) infections among travellers from Wuhan, China, 20-28 January 2020. Euro Surveill 2020:25. doi: 10.2807/1560-7917.ES.2020.25.5.2000062.
5. Lauer SA, Grantz KH, Bi Q, Jones FK, Zheng Q, Meredith HR, et al. The incubation period of coronavirus disease 2019 (COVID-19) from publicly reported confirmed cases: estimation and application [published online ahead of print March 10, 2020]. Ann Intern Med doi: 10.7326/M20-0504.
6. Metcalf CJE, Ferrari M, Graham AL, Grenfell BT. Understanding herd immunity. Trends Immunol 2015;36:753-5.
7. Brooke CB. Population diversity and collective interactions during influenza virus infection. J Virol 2017;91:e01164.
8. Fang L, Karakiulakis G, Roth M. Are patients with hypertension and diabetes mellitus at increased risk for COVID-19 infection? Lancet Respir Med 2020;8:e21.
9. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet 2020;395:497-506.
10. Gimbrone MA, García-Cardeña G. Endothelial cell dysfunction and the pathobiology of atherosclerosis. Circ Res 2016;118:620-36.
11. Lescure FX, Bouadma L, Nguyen D, Parisey M, Wicky P-H, Behillil S, et al. Clinical and virological data of the first cases of COVID-19 in Europe: a case series [published online ahead of print March 27, 2020]. Lancet Infect Dis doi: 10.1016/S1473-3099(20)30200-0.
12. Schuetz P, Wirz Y, Sager R, Christ-Crain M, Stolz D, Tamm M, et al. Procalcitonin to initiate or discontinue antibiotics in acute respiratory tract infections. Cochrane Database Syst Rev 2017;10:CD007498.
13. Alhazzani W, Møller MH, Arabi YM, Loeb M, Gong MN, Fan E, et al. Surviving sepsis campaign: guidelines on the management of critically ill adults with coronavirus disease 2019 (COVID-19) [published online ahead of print March 28, 2020]. Crit Care Med doi: 10.1007/s00134-020-06022-5.
14. Chen T, Wu D, Chen H, Yan W, Yang D, Chen G, et al. Clinical characteristics of 113 deceased patients with coronavirus disease 2019: retrospective study. BMJ 2020;368:m1091.

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