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Diabetic Foot Syndrome in the COVID-19 era: How to Move from Classical to new Approaches

Roberto Anichini, MD[1], Claudia Cosentino, MD[1], and Nikolaos Papanas, MD, PhD[2]

Abstract

Diabetic foot syndrome (DFS) is a major complication of diabetes mellitus. Coronavirus infectious disease 2019 (COVID-19) has created new necessities and priorities in DFS management. These include telemedicine and patient triage to minimise hospitalisation and visits to the clinic. Moreover, new studies will be needed to evaluate whether the lockdown in patients with DFS or in those with high risk of DFS have increased the risk of deteriorating outcomes, including limb loss. Our future challenge will lie in re-organising our world during the pandemic and after its resolution. We need more awareness of the widespread ways of the changes in taking care of patients and to improve education, skills, and behaviour of high-risk patients.

Keywords

COVID-19, diabetic foot, diabetic foot ulcers, management, telemedicine

The novel coronavirus causing coronavirus infectious disease 2019 (COVID-19) is the cause of a new pandemic. People with diabetes are at higher risk both of infection and severe disease from COVID-19. Diabetes mellitus seems to be independently associated with COVID-19 severity and increased mortality.[1] Furthermore, diabetic complications (cardiovascular disease, heart failure and chronic kidney disease) increase COVID-19 mortality.[2] Vaccination rates differ greatly between countries and induce variation in hospitalisation and mortality rates among geographic areas. Moreover, the new Omicron variant renders progress of the pandemic even more complex and difficult to predict. In this context, re-organisation of diabetic foot care represents a huge challenge.[3]

Diabetic foot syndrome (DFS) is a major complication of diabetes mellitus. It includes peripheral arterial disease (PAD), peripheral neuropathies, postural instability, osteopenia, osteoporosis, fractures, Charcot neuroarthropathy, ulcers, infections, and amputations. The 5-year mortality rate following amputation is estimated at 39-68%.[4] In a recent systematic review, Zhang et al[5] found that global diabetic foot ulcer (DFU) prevalence was 6.3%. In addition, in a recent review, recurrence rates of DFU were high, approximately 22.1% per person-year.[6] Moreover, Armstrong et al[7] estimate that roughly 40% of patients experience ulcer recurrence within 1 year after ulcer healing and 65% within 5 years. Fortunately, improved care has resulted in a clinically significant reduction in major amputations among people with diabetes in recent years (- 29.8%).[8]

The pandemic has posed many challenges in the management of people with diabetes particularly with risk factors for foot ulceration. In fact, the pandemic has resulted not only in the closing of most outpatient clinics but also in the inability to perform most laboratory and imaging investigations. In this challenging era, several authorities have issued recommendations and guidelines: the American Podiatric Medical Association,[9] the International Working Group on Diabetic Foot (IWGDF),[10] King's College Hospital [11], and D-foot international.[12]

The remote triage system for lower-extremity wounds has been recommended to avoid hospital admissions where possible. Remote patient monitoring was appropriate for uncomplicated foot ulcers which are non-infected and non-ischaemic, for mild infections (superficial ulcers and local erythema <2 cm from the edge without signs of tracking in tissues or sepsis) or for inactive Charcot foot. Therefore, new modes of patient consultation have widely been used during the pandemic including the use of telemedicine.[13] The latter can be defined as the delivery of healthcare services from a distance through

[1]Diabetic Foot Unit Pistoia Usl Centro Toscana, Italy
[2]Diabetic Foot Clinic, Diabetes Centre, Second Department of Internal Medicine, Democritus University of Thrace, Alexandroupolis, Greece

Corresponding Author:
Nikolaos Papanas, Diabetes Centre, Second Department of Internal Medicine, Democritus University of Thrace, University Hospital of Alexandroupolis, Greece.
Email: papanasnikos@yahoo.gr

telecommunication technologies, notably telephone consultations, video-call consultations, photographs and instant messaging.[14]

Generally, face-to-face consultation was recommended for patients with mild or moderate infections, including osteomyelitis, dry gangrene, deteriorating foot ulcers or active foot Charcot. Appropriate debridement could prevent ulcer deterioration. For active foot Charcot or for neuropathic DFUs, indeed, immediate execution of off-loading is the key to avoid instability and or worsening of lesions and future ulceration.[9-12] Hospitalisation was reserved for critical situations like limb and/or life-threatening conditions that fall into the following groups: severe infection, sepsis, severe ischaemia and acute ischaemia. Patients were admitted to hospital if they required revascularisation, surgical intervention or intravenous antibiotic therapy.[9-12]

This system of triage, developed during the first 2020 lockdown, was advisable to avoid unnecessary diabetes-related hospital admission and to reduce risk of COVID-19 exposure in the hospital. There are several potential general barriers to providing a telemedicine diabetic foot service: many healthcare settings are not appropriately equipped to provide this service; many patients could be unable to use technology due to age and socio-economic status.

A report from Rome described the result of a new triage system.[15] This study included 151 patients seen since February 2020 and of these, only 3 required a major amputation. The authors concluded that this triage pathway provided adequate management of DFUs during the pandemic and there were no cases of hospital-acquired COVID-19 infections.[15] Similar satisfactory results were reported in a study from Manchester and Los Angeles.[14] Overall, this paradigm shift based on reduced clinic visits and hospitalisation with increased web-based foot care emerged as very promising and did not compromise outcomes.[15,16]

Two further retro-prospective, observational cohort studies observed the similar number of amputations following foot ulcers during the pandemic compared with the pre-pandemic period.[17,18] By contrast, other authors have reported an increased rate of major or minor amputations during the pandemic attributed to predominantly ischaemic ulcers or non-infected DFU.[19-22] Thus, we should not be over-enthusiastic until more conclusive data on amputation rates become available.

To date, the problem of COVID-19 has certainly not been overcome. Indeed, we should bear in mind that the relationship between COVID, diabetes and chronic complications is complex,[23,24] and this even extends to choice of anti-diabetic treatment with potential additional beneficial effects on COVID-19 itself.[25,26] Thus, we should consider what has changed, what is changing and what will change.

Essentially, the pandemic has affected every subgroup of patients in different ways. Outpatients receiving regular visits in the diabetes clinic have witnessed a reduction in contact or have lost contact. New studies will be needed to evaluate whether the lockdown in patients with diabetic foot or those with high risk of diabetic foot have increased the risk of deteriorating outcomes, including limb loss. Furthermore, given that many subjects with diabetes have been affected by COVID-19, it may be necessary to consider a re-classification of the risk of developing diabetic foot. In such approach, previous COVID infection might represent an additional aggravating factor due to the aspects of vascular compromise associated with coronavirus infection. Thirdly, the general population was affected by COVID-19 as well, and was treated with potentially hyperglycaemic drugs. Both such treatment and COVID-19 *per se* are known to increase the risk of incident diabetes.[27] Arguably, new diabetes cases would tend to increase the long-term burden of diabetes complications, overloading healthcare providers.

We need to strictly check our patients, but the continuing pandemic might delay or inhibit the restoration of complete normality in diabetic foot care. For this reason, it will be necessary to reconsider health management of chronic patients, creating an integrated approach between face-to- face and digital contact in order to render our foot care services flexible and efficient. We should not be oblivious to the fact that COVID-19 itself has been reported to cause foot lesions (primarily in the toes) in subjects with or without diabetes,[28-30] further increasing the complexity of the issue.

In conclusion, our future challenge will lie in re-organising our world during the pandemic and after its resolution. We need more awareness of the widespread ways of the changes in taking care of patients and to improve education, skills, behaviour of a high-risk patient in active self-monitoring. We also need to improve our healthcare system, so as to quickly identify high-risk patients and treat them faster through integrated systems of both physical and digital contact. Such improved healthcare is expected to need dedicated training of healthcare providers, including junior doctors and, perhaps, even medical students.[3] Certainly, it will be even more challenging to study the effect of COVID-19 on diabetic foot in terms of new ulcerations, mortality and amputations during several years following the pandemic. However, it will be difficult to predict or assess the relative impact of the pandemic in the years to come. The cyclical nature of the pandemic has imposed more or less drastic closures at different times in different areas of the world and this will render such analysis very complex.

This journal is continuously contributing to our increase in knowledge, offering new high-quality data, including the effects of the pandemic on undergraduate medical education.[31-34] In addition, during the next few years we should carefully monitor patients with previous COVID-19 infections in order to understand if the previous infection increases the risk of DFS or amputation or death.

Author Contributions

All authors conceived this manuscript. Roberto Anichini and Claudia Cosentino wrote the first draft. Nikolaos Papanas edited and finalised the manuscript.

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Ethical Approval

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ORCID iDs

Roberto Anichini https://orcid.org/0000-0002-8227-9388
Nikolaos Papanas https://orcid.org/0000-0002-7320-785X

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