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Biomarker Development for COVID-19 Point-of-Care Diagnosis

Martina Kandulski*

Department of Hematology, University of Defense, Trebesska 1575, Czech Republic

Abstract

Coronavirus disease is a highly contagious infection that has triggered a pandemic in 2019. Early disease diagnosis has been identified as one of the most important approaches to reducing pathological impact and infection spread. Point-of-care tests have proven to be valuable analytical tools, particularly lateral flow immunoassays. Biosensors have grown in popularity in recent years. These are simple but highly sensitive and precise analytical devices made up of a selective molecule like an antibody or antigen and a sensor platform. Biosensors would be a more advanced alternative to current point-of-care tests and standard laboratory methods for COVID-19 diagnosis. Recent breakthroughs in COVID-19 point-of-care diagnostic tests, as well as the development of biosensors for specific antibodies and viruses.

Keywords: Antibody • Antigen • Coronavirus disease • Diagnosis

Introduction

The World Health Organization has declared Coronavirus Disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2, a pandemic. Many strategies have been established to prevent the spread of the disease since the pandemic began. It is possible to mention the use of protective measures, the quarantine strategy, travel restrictions, and vaccination. These approaches were ineffective in establishing national strategy countermeasures to COVID-19, and the countermeasures had unintended consequences, including a social impact on the population and economy. The increased emphasis on COVID-19 also limits healthcare capacity for other diseases that can manifest in other areas, such as cancer therapy and prevention [1].

One of the fundamental approaches in COVID-19 countermeasures is explicit disclosure of disease onset, which reduces unspecific precautions that cause collateral damage and expenses. Since the beginning of the pandemic, significant progress has been made in instrumental methods for COVID-19 diagnosis, and new analytical methods have been developed. Because capacity was limited and some regions were not even equipped to perform instrumental diagnoses, point-of-care tests, biosensors, and portable bioassays were identified as critical tools. The rapid advancement of biosensors and point-of-care tests for COVID-19 diagnosis occurred soon after the pandemic began [2].

Description

Biosensors are analytical devices that combine a biomolecule, also known as a biorecognition element, with a sensor transduction system, also known as a physicochemical transducer. An analyzer measures the incoming signal in the form of a physical property. This review focuses on the development of new biosensors that are suitable for testing at the point-of-care or in handheld assay conditions for the diagnosis of COVID-19 by detecting specific parts of the viruses infected people. The current trends and literature on this subject are reviewed here. When COVID-19 was discovered, the review included a comparison with the currently available point-of-care tests as well as a discussion about the limitations of various diagnostic approaches [3,4].

Since the early stages of the pandemic, lateral flow tests have been the primary analytical tool for COVID-19 diagnosis. Lateral flow tests are a simple analytical tool that has gained popularity. The first applications of lateral flow tests focused on revealing, but additional analytes followed, and the tests gained popularity as tools for analysing biochemical and immunochemical markers, toxins, microorganisms, pollutants, drugs, pharmaceutics, and others. These devices resemble biosensors, and some researchers believe they are a type of biosensor. When compared to other types of biosensors, lateral flow tests lack a physical sensor because colour is read with the naked eye. Some companies, on the other hand, provide colorimetric readers, so lateral flow tests combined with colorimetric readers can be considered.

The lateral flow test principle is based on an affinity interaction between a recognition molecule immobilised on a matrix and another recognition molecule labelled with a dye, fluorescent label, coloured or fluorescent nanoparticles, or other molecule allowing visualisation. A typical recognition molecule used in lateral flow tests is the antibody, but aptamers have also gained popularity for the purpose, and various antigenic and receptor structures are also suitable for testing. During the assay, the analyte interacts with the labelled recognition molecule while also migrating on the matrix via capillary flow. Migration is halted by capturing the complex-analyte-labeled recognition molecule by another analyte recognition molecule that is chemically bound to the matrix and forms the lines that the user sees [5].

Antibodies are easily detected by a piezoelectric biosensor. This assay was described for detecting various pathological states using a quartz crystal microbalance as the sensor platform. This type of biosensor is still uncommon for the development of new point-of-care tests for diagnosis, but they are quite useful for the purpose, and interest in piezoelectric platforms may grow in the future. The main advantage of the piezoelectric platform is the ability to create a label-free assay that specifically measures the mass of the analyte catch on the biosensor surface by determining the oscillation frequency dropping due to the bound mass. The principle of antibody assays using a piezoelectric biosensor can be learned.

***Address for Correspondence:** Martina Kandulski, Department of Hematology, University of Defense, Trebesska 1575, Czech Republic; E-mail: kandulskimartina@gmail.com*

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Conclusion

Biosensors are now fully competitive with other analytical and diagnostic point-of-care tests, and they can help to improve the care of COVID-19 patients by making disease diagnosis more accurate and available, and assay results more plausible. When compared to the two types of COVID-19 biosensors, the anti-SARS-CoV-2 antibodies assay appears to be less practical for point-of-care conditions due to potential problems with blood sample collection by inexperienced staff and possible false negative diagnosis in the early stages of the disease. Nonetheless, both types of biosensors have the potential to be used in medical practise.It is possible that findings and new technologies in the field of biosensors for the diagnosis of COVID-19 will be put into practise, and commercialization of the inventions will be one of the next steps. The extent to which the findings are implemented will be determined by the progression of the COVID-19 pandemic and the urgency with which it must be resolved. However, findings related to COVID-19 diagnosis can be easily adapted to the diagnosis of other infectious diseases, and thus they can have a practical impact even if the COVID-19 pandemic is successfully suppressed.

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Conflict of Interest

There are no conflicts of interest by author.

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