Precision Cancer Medicine and Mathematics

Yongkeun Park

Catholic Kwandong University College of Medicine

Department of Surgery, CKU International St. Mary's Hospital

ykpark@ish.ac.kr

When patients are diagnosed with cancer, they usually receive the same treatment as others who have the same stage of cancer. It works for some patients but not for many others. Because we don't fully understand how cancers develop and what the most important factor is in their progression, our efforts to treat these diseases are often imprecise, unpredictable and ineffective. In addition, there is still no established treatment strategy for some types of cancers.

Precision medicine, also called personalized medicine, is expected to make ways that allow doctors to select the right treatments that are most likely to help patients based on their specific conditions. [1] The ultimate goal of it is to deliver the right treatment to the right person at the right time. [2] These attempts are based on the belief that cancer treatment can be tailored to the genetic background of each patient's cancer cells, to the status of the tumor itself, and to patient's physiologic status. The idea of precision medicine is not new, but recent advances in science and technology have helped speed up the pace of this area of research. [1] Nowadays, we can easily get big data from clinical or molecular biology field. However, a more innovative method is also needed to analyze this data and obtain practical conclusions. Quantitative, patient-specific information which is integrated via algorithmic analyses can aid patient stratification, monitoring and treatment design. [2] This is where mathematics comes into play a very important role.

Mathematics is not new in medicine. Statistics have long been used to describe the result in observational studies and clinical trials. The application of mathematical models in medicine also has a long history, and increasing attention has been paid to it, being expected to give a clue of dissecting complex disease mechanism. Theoretical models expressed mathematical equations can describe mechanisms of diseases as a systematic approach. It aims to identify critical parameters or to show how changes in parameter values affect the mechanism of a disease. [3,4] We hope it will not only provide us with a clue to understanding the disease but will also help us make an accurate decision in health care.

In this talk, it will be presented how mathematics can aid us in making clinical decisions for patients with cancer and in understanding the molecular mechanism of cancer development.

REFERENCES

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