DEFINING PRECISION MEDICINE AND THE NEW CONCEPTS OF P-TO-P MEDICINE

PRECISION MEDICINE IN CARDIOLOGY
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PERSPECTIVE

HIGHLIGHTS

This article updates the current definition of precision medicine. The views expressed in this article are those of the author himself and do not necessarily represent the position of the journal editorship.

ABSTRACT

There is the need for further defining the term precision medicine due to lack of its authoritative or official definition. After head-to-head comparison of all existing terms and their definitions, the term precision medicine is more frequently used in basic and clinical medicine, because it may best reflect the whole profile of all relevant terms, with something new or different from others. This essay is the first step in the process of updating the definition of precision medicine on the basis of modern concepts of precision medicine and other similar definitions, in particular personalized medicine, some of which are often used interchangeably. As our understanding of precision medicine advances, we must take multidimensional aspects of precision medicine into account. After making efforts, we may one day achieve the vision that is expected for precision medicine.

KEY WORDS

Concept; definition; precision medicine; P-to-P medicine; term; terminology

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PERSPECTIVE

Medicine is a science of uncertainty and an art of probability. If it were not for the great variability among individuals, medicine might as well be a science and not an art.

– Sir William Osler (1892)

It has long been recognized that matching an appropriate intervention or treatment strategy to the unique biological nature or clinical characteristics of a given individual patient is nothing new. In the early 20th century, discovery of blood groups led to the first example of precision medicine [1–3]. Since then, the safety of red blood cell transfusion has been improved greatly through matching blood donors with their recipients. In fact, matching blood type for transfusion has become the most common routine clinical practice for almost one century. However, protocol-driven strategy designed for the general patient population may benefit the majority, but still proves suboptimal or even harmful for a substantial minority, such as those negative for common blood group antigens, positive for multiple alloantibodies, or due to uncommon or even rare red blood cell units, indicating that red blood cell transfusion seems to be less precise than we thought [3]. Subsequent clinical research studies have suggested that extended typing or extended antigen matching has gradually improved precision in the personalized matching of red blood cell units, with more potential benefits added and risk for developing alloimmunization minimized as a consequence of further improved typing accuracy. This case clearly demonstrates that the concept “precision medicine” has evolved over the years.

Through tailoring the prevention and treatment of disease to individual variations in genetic and non-genetic factors, precision medicine used to be introduced as an independent medical discipline at its early stage. Precision medicine must appreciate earlier pioneers in this field. In my opinion, Professor Archibald E. Garrod (1857 – 1936), the first person to appreciate the ubiquity of individual variation (also known as chemical individuality) in both health and disease, is the father of precision medicine and also the founder of medical genetics as well as one of the most highly acclaimed physicians of his day [4]. Since Garrod's time, advances in our thorough understanding of individual variability in the predisposition to disease and in response to medication, together with the emergence and application of omics-related biotechnologies, have made precision medicine moving forward to its future avenues [5].

Precision medicine comes of age after announcement of a first US national Precision Medicine Initiative [6–8]. From the literature, the term “precision medicine” was also named as customized medicine, individualized medicine, personalized medicine, predictive medicine, preventive medicine, stratified medicine, tailored medicine, or targeted medicine and more [9]. Moreover, additional compound terms were also proposed and detailed, respectively [10], such as P4 (personalized, predictive, preventive, and participatory) medicine [11], and extended P5 (i.e., P4, plus psycho-cognitive) medicine [12,13]. Of them, the terms precision, personalized, and individualized medicine are often used interchangeably [9,14–16]. In general, the term precision medicine implies something new or different from others, that is, the select treatment strategy would likely be more precisely tailored to specific molecular targets [14]. Now most of scientists and clinicians could prefer the term “precision medicine” to emphasize the new aspects of this field, which is being driven by novel diagnostics and therapeutics that are emerging rapidly [5,9,14].

Because multiple terms and definitions exist to describe specific aspects of precision medicine, defining precision medicine further is of clinical importance. By definition, the word "precision" refers to a measure of the deviation from true value and its scatter (see Wikipedia). Although the meanings of some broad concepts are somehow hard to define [17–21], the term precision medicine is still considered as only one end of the spectrum that constitutes different terms that are used interchangeably (see above), which is reflective of either consistency of prediction with real health outcomes of an individual patient in clinical settings or somewhat differences in between. In addition to its two important contents (personalized medication and characterized disease subset), precision medicine sometimes seems more like an aspiration or slogan than a definition [16], such as “right patient, right drug, right dose, right time”.

In this essay, two “P-to-P” concepts are proposed, one is population-to-person medicine [22], and the other is prediction-to-perfection medicine. Due to the complexity and multiplicity of the life process, there is always uncertainty (i.e., the sum of known unknown proportions of the whole thing), which may vary by the individual, specific disease, or both in combination. Therefore, precision medicine would likely be more precise only when unknown pieces of the puzzle (the individual patient with certain disease on medication) are narrowed to smaller over time [5].

If medicine were a science of uncertainty and an art of probability, precision medicine might be a scientific art about human therapeutics.

– Dr Hong-Guang Xie (2016)
CONFlict of interest

The author has no conflicts of interest to declare.

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