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Personalized Psychiatry

Gökben Hızlı Sayar*[1] and Nevzat Tarhan[1]

[1]Psychiatrist, Uskudar University, Turkey

***Corresponding author:** Gökben Hızlı Sayar, Psychiatrist, Üsküdar University, Istanbul, Turkey, Tel No: +902164002222; Email: gokben.hizlisayar@uskudar.edu.tr

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Editorial

Personalized medicine refers to the application of patient-specific profiles, consolidating genetic and genomic data as well as clinical and environmental factors, to assess individual risks and tailor prevention and treatment strategies. The primary assumption of personalized medicine is that a patient's unique biological characteristics play a significant role in both disease vulnerability and response to particular treatments [1]. With the accelerated progress in the fields of biotechnology, genetics, and genomics, molecular genetic profiling, personalized medicine has great potential to yield significant health and economic benefits for patients and community. Better clinical decisions, choosing the appropriate therapies that are tailored to an individual patient, optimizing disease prevention strategies, increasing therapeutic efficacy and reducing adverse effects, shortening treatment process, reducing healthcare costs, increasing patient compliance are some benefits.

In modern pharmacology, the current drugs are developed and approved for particular disorders after being tested in a large population. However, for individual patients, the conventional "one-drug-fits-all" strategy does not always operate. There is noteworthy individual variation in treatment responses; some patients show no response, whereas others manifest excellent response. It is evident that a more individualized approach is needed. Personalized medicine, also referred to as individualized medicine, means the prescription of specific treatments and therapeutics best suited for an individual taking into consideration both genetic and environmental factors that influence response to therapy. In personalized medicine, diagnostic, prognostic, and therapeutic strategies are precisely tailored to each patient's unique requirements.

The pharmacogenetic and pharmacogenomic tests are a vital part of personalized medicine. Pharmacogenetics is the study of variability in drug response due to genetic factors and includes the prediction of a patient's response to specific therapy and susceptibility to toxicity and adverse events. Pharmacogenetic data may inform both the selection of a particular treatment and the individualized dose and dosing schedule for that treatment. A pharmacogenomic test is an essay intended to study individual variations in whole-genome or candidate gene, SNPs, haplotype markers, or alterations in gene expression or inactivation that may be correlated with pharmacological function and therapeutic response.

The pharmacological effect of a drug depends on the pharmacodynamics (interaction with the target or the site of action) and pharmacokinetics (absorption, distribution, and metabolism). It also covers the influence of various factors on these processes. It is of considerable importance to know the metabolic status of an individual, mainly when using drugs with a narrow therapeutic range. The individual metabolic differences cause variations in therapeutic responses. Age, sex, body weight, smoking, alcohol consumption, concomitant diseases, drug-drug interactions can cause variations in drug metabolism. However, the most crucial factor is the genetic variance between individuals such as polymorphisms of drug metabolizing enzymes, transporters, receptors. The variance in drug metabolism

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may lead to supratherapeutic or toxic plasma drug levels and adverse reactions. Also sub therapeutic drug levels and inadequate treatment response may also be observed.

The general principles of personalized medicine apply to psychiatric disorders, and this may be referred to as personalized psychiatry. Variability of the drug response is a significant problem in psychiatry. Between 20% and 30% of the patients do not respond adequately to initial therapy, and it might take several months to understand that the patient is not responding [2]. Genetic mutations in metabolic enzymes can render them inactive and result in the toxic accumulation of drugs or drug metabolites. Many psychotropics, including antipsychotics and antidepressants, are metabolized to a significant extent by the polymorphic cytochrome P450 enzymes, which show significant interindividual variation in activity [3].

The serotonin transporter is the molecule that controls the level of serotonin and determines the movement of serotonin between cells. It is influenced by genes that are inherited. An individual with a change in the DNA that encodes the serotonin transporter may have a reduced ability to move serotonin. Therefore, this person may be less likely to respond to antidepressants that target serotonin and more likely to experience side effects from these medications related to excess serotonin levels.

Also, calcium channel signalling genes found to be important in bipolar disorder, major depressive disorder, attention deficit hyperactivity disorder, and schizophrenia. Variations in the dopamine receptor gene found to be important in response to antipsychotic treatment in schizophrenia. Genetic variation in dopamine receptors can influence their binding and functional capabilities, affecting the efficacy of the treatment.

Personalized medicine is not only related to pharmacogenetics or pharmacogenomics, but also circadian rhythms. Circadian rhythms are the endogenous oscillations in physiological and metabolic processes with a period of 24 hours, such as sleep-wake circles, body temperature, or hormone secretions. Chronopharmacology is the study of rhythmic, predictable-in-time differences in the effects and/or pharmacokinetics/dynamics of drugs both in animals and in humans [4]. The half-life of a drug can vary as a function of the hour of administration. The efficacy and toxicity of drugs depend on an individual's circadian rhythm. Drug administration at the appropriate time of the circadian rhythms can improve the outcome of pharmacotherapy and decrease the adverse effects of the drug [5].

Personalized medicine requires biomarkers. Recent advances in neuroimaging have transformed the recognition of the pathophysiology of neuropsychiatric disorders. In psychiatry, electroencephalography (EEG) might be a useful tool as a biomarker. Resting state and sleep EEG's and event-related potentials can discriminate patients from healthy subjects, and also can be used for the prediction of treatment outcome in various psychiatric diseases [6]. In major depressive disorder, the differences in the EEG alpha and theta frequency range during rest have been reported consistently, and both these measures have also been differentially found to be associated with treatment outcome [7]. As a potential electrophysiological biomarker, EEG may give a chance the clinician to tailor the therapy for an individual patient.

It is anticipated that psychiatric patients will likely be treated soon with drugs that are personalized for their unique biological characteristics. Integrating a range of tools to tailor the treatment which are feasible to use in clinical settings will likely provide improved outcomes.

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