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Pharmacogenomics: New Personalized Medicine Approach

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Ineffective treatments and the management of adverse drug reactions are responsible for a large proportion of health resources. Drug response and toxicity are significantly influenced by genetic variations in drug-metabolizing enzymes, transporters, and targets. This information may be used to help in selecting the appropriate drug and dosage. One of the newest methods of precision medicine is pharmacogenomics, which adjusts drug selection and dosage based on a patient's genetic characteristics. Pharmacogenomics can reduce the chances of negative effects of the drugs and increase the chances of successful treatment, as the medicines are only for the targeted individuals. It can also revolutionize the healthcare industry to be more specific. The main reason that drugs and their dosages are designed based on individuals' genetic characteristics is that they have a great influence on drug metabolism and its response. The main evidence is the link between dosage requirements and genetic differences in drug transporters such as p-glycoprotein (ABCB1) and OATP-C (SLC21A6), and drug-metabolizing enzymes such as cytochrome P450 (CYP) 2D6, CYP2C19, and CYP2C9. Polymorphisms in these enzymes can alter the drug metabolism phenotype. As these are all proteins translated from genetic information, any change or point mutation can increase or decrease the effectiveness of the enzymes. This can cause more adverse effects in some individuals. Every individual's body function is unique, and its right to say that the dosage of drugs depends on that. Many pharmacogenomic tests and their outcomes have confirmed the potential to improve therapeutic activities. In the field of oncology, the use of this technique to establish a connection between drug metabolism and genetic biomarkers is more reliable, effective, and precise. PD-L1 expression analysis is an example of pharmacogenomics potential. Expression analysis helps physicians select which cancer patients are suitable for immunotherapy techniques. Survival rates for lung and other cancers have drastically increased by comparing the genetic factors and immunotherapies that trigger the immune response against tumors. Similarly, pharmacogenomics has promising potential in antiviral drugs. It targets the genes that influence such drugs to predict treatment success. Therefore, as our understanding of the genome becomes clearer, the potential of pharmacogenomics will also grow. Although this is a very promising technique and many scientific organizations are pursuing this approach, there has been very little success in implementing it in clinical trials. Targeted drugs are very costly, as they require the identification of candidate genes and drug responses to these genes. Acceptance is another matter to focus on as most people are not comfortable with these approaches; they prefer conventional approaches. Implementation, cost, acceptance, defining targeted genes, and defining drug responses are all barriers to pharmacogenomics right now. Physicians and patients must adapt to avoid the side effects of drugs by implementing a personalized medicine approach. Despite growing interest, the adoption of pharmacogenomics is still in its early stages of development. Attempts to fully apply pharmacogenomics to enhance health will likely take decades. It is important to find a balance between equality concerns across varied populations and increased healthcare efficiency to successfully implement pharmacogenomics. This can be done more effectively through coordinated studies and worldwide collaboration. This not only makes it possible to better utilize resources and knowledge but also sparks political interest in and support for the personalized medicine approach.