



Personalized Drug Therapy: Individual Patient Profiles for Safer and More Effective Medication

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DESCRIPTION

Personalized drug therapy is an approach to medication management that considers the biological and clinical characteristics of an individual when selecting a medicine and determining its dose. Patients with the same diagnosis can respond differently to an identical treatment because of variations in genetics, metabolism, disease characteristics, age, organ function, lifestyle and other factors. Considering these differences can support safer prescribing and improve the likelihood of achieving an appropriate therapeutic response. Genetic variation is an important component of personalized drug therapy. Differences in Deoxyribonucleic Acid (DNA) can affect enzymes responsible for drug metabolism, transport proteins, receptors and other molecular structures involved in medication activity. Variants in genes such as *Cytochrome P450 2D6*, *CYP2C19* and *CYP2C9* can influence how quickly selected medicines are processed in the body. Some individuals may metabolize particular medicines slowly, while others may process them more rapidly. These differences can influence drug concentration and therapeutic effects.

Pharmacogenomic testing can identify selected genetic variants before a medicine is prescribed or during treatment. When clinical guidelines support testing for a particular medicine, the results can help healthcare professionals select an appropriate medication or adjust the starting dose. Genetic information should be considered together with clinical characteristics because genes are only one factor affecting medication response. Protein characteristics also contribute to personalized treatment. Proteins act as drug targets, metabolic enzymes, transporters, receptors and signaling molecules. Differences in protein abundance or activity can influence how a medicine produces its effects. Pharmacoproteomic profiling can identify protein patterns associated with treatment response, disease activity, or unwanted medication effects. This information can complement genetic findings and provide additional information about biological activity.

Metabolomic information can further support individualized medication decisions. Metabolites are small molecules produced during normal biochemical processes. Their levels can change because of disease, diet, medication exposure, or changes in cellular activity. Measuring selected metabolites can provide information about how the body is processing a medicine or responding to treatment. Combining metabolic information with genetic and protein measurements can provide a broader view of individual response. Pharmacokinetics is another important consideration. It describes how a medicine is absorbed, distributed, metabolized and eliminated. Kidney and liver function can strongly influence drug concentrations. Age, body weight, nutritional status, gastrointestinal function and interactions with other medicines can also affect drug exposure. Personalized dosing takes these factors into account when appropriate, particularly for medicines that require careful concentration control.

Therapeutic drug monitoring can be useful for selected medicines. Blood or plasma concentrations can be measured at specific times and compared with established therapeutic ranges or clinical targets. The result can be interpreted together with the prescribed dose, treatment schedule, organ function and clinical response. This approach can help identify patients who may need dose adjustment. Cancer treatment is an important area for personalized drug therapy. Tumors can contain molecular alterations that differ among patients. Genetic mutations, protein expression patterns and other molecular characteristics may influence sensitivity to specific medicines. Molecular testing can identify selected features that support treatment selection. During treatment, changes in molecular markers may also provide information about response or emerging resistance.

Personalized drug therapy is relevant to infectious diseases as well. Microorganisms can differ in their susceptibility to antimicrobial medicines, while patients differ in immune function, organ function, previous medication exposure and other characteristics. Identification of the infectious organism

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and its susceptibility profile can help select an appropriate antimicrobial agent. Patient-specific factors can then guide dose and treatment duration. Adverse drug reactions are another important consideration. Some people carry genetic variants associated with an increased risk of particular reactions to specific medicines. Testing for selected variants can identify individuals who may need an alternative treatment when clinical recommendations support such testing. This approach can reduce exposure to medicines that may produce serious reactions in genetically susceptible individuals.

Medication interactions must also be considered in individualized therapy. One medicine can alter the metabolism

or transport of another, causing drug concentrations to rise or fall. Food, supplements, alcohol, smoking and other exposures can also affect medication activity. A complete medication history helps healthcare professionals recognize factors that may influence treatment outcomes. Patient preferences and treatment behavior are important as well. A medication plan should consider the patient's ability to follow the dosing schedule, previous experiences with medicines, daily routine and preferences regarding treatment. Clear communication can help patients understand why a particular medicine or dose has been selected and why monitoring may be necessary.