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A REVIEW ON PHARMACOGENOMICS

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ABSTRACT

Pharmacogenomics is the area of pharmacology that examines how genetic variation affects a patient's reaction to a medication by linking gene expression or single-nucleotide polymorphisms to a drug's toxicity or effectiveness. It seeks to create logical ways to optimize medication therapy in relation to the patient's genotype in order to guarantee maximal effectiveness with few side effects. The development of personalized medicine, where medications and drug combinations are tailored to each person's distinct genetic composition, is promised by these methods. The whole genome application of pharmacogenetics, which studies how medications interact with individual genes, is called pharmacogenomics.

KEYWORDS: Pharmacogenetics; Single nucleotide polymorphisms; Genomics; Genotype.

The study of how a person's genetic makeup influences how their body reacts to medications is known as pharmacogenomics. The term refers to the nexus of pharmaceuticals and genetics and is derived from the words pharmacology and genomics.

IMPORTANCE OF PHARMACOGENOMICS

The terror of a serious adverse reaction to a prescription medication is not adequately captured by Adverse Drug Reaction. However, such unfavorable responses are still possible. Adverse drug reactions (ADRs) are one of the main causes of hospitalization and death in the United States, accounting for over 2.2 million serious cases and over 100,000 deaths in 1994, according to a 1998 study of hospitalized patients published in the Journal of the American Medical Association. For example, the daily doses needed to treat people with Parkinson's disease vary by 20 times for warfarin, 40 times for propranolol, an antihypertensive

medication, and 60 times for L-dopa.Some medications are clinically useful in a subset of patients with a particular pathology; for example, antipsychotics are useless in 30% of schizophrenics, indicating that they are only useful in people with particular illness etiologies. If the doctor had prior knowledge of the patient's genetic profile, which dictates the drug reaction, many of the deaths could have been prevented. Pharmaceutical corporations are forced to create treatments using a one-size-fits-all approach since there is currently no easy way to predict whether people would respond favorably, poorly, or not at all to a prescription. The creation of medications that the typical patient will react to is made possible by this technique. However, as the aforementioned data demonstrate, one size does not fit all, often with disastrous outcomes. A solution to the issue of ADRs must be found before they occur. However, pharmacogenomics appears to be the answer.

PHARMACOGENOMICS TODAY

More than thirty different medication classes are broken down by the cytochrome P450 (CYP) family of liver enzymes. The ability of these enzymes to digest specific medications may be impacted by DNA polymorphisms in the genes that code for them. Patients may overdose on medicines due to less active or inactive CYP enzymes that are unable to effectively break down and remove substances from the body. Genetic assays for cytochrome P450 gene variants are now used by clinical trial researchers to evaluate and track individuals. Furthermore, a lot of pharmaceutical companies test their chemical compounds to determine how well different types of CYP enzymes can break them down.

PHARMACOGENOMICS FUTURE

Drug design will be impacted by recent advancements in this area on three primary levels:

(1) the drug's interaction with its receptor binding site

(2) the drug's absorption and distribution.

(3) the drug's removal from the body.

BENEFITS OF PHARMACOGENOMICS

Pharmacogenomics integrates annotated knowledge of genes, proteins, and single nucleotide polymorphisms with conventional pharmaceutical sciences like biochemistry. The advantages are listed below.

1. More potent medications

The proteins, enzymes, and RNA molecules linked to genes and illnesses will allow pharmaceutical companies to develop medications.

2. safer, better medications initially

Doctors will be able to assess a patient's genetic profile and prescribe the best available pharmacological therapy from the start, as opposed to the traditional trial-and-error process of matching patients with the proper pharmaceuticals.

3. More precise techniques for figuring out the right amounts of medications

Dosages based on a person's genetics—that is, how well the body processes the medication and how long it takes to digest it—will replace the current ways of basing dosages on weight and age. This will reduce the risk of overdosing and optimize the therapeutic benefit.

4. Advanced disease screening

A person can prevent or minimize the severity of a genetic disease by making appropriate lifestyle and environmental changes at a young age if they are aware of their genetic code.

5. Improved immunizations

Genetic material (DNA or RNA) vaccinations offer all the advantages of current vaccines without all the hazards. They won't be able to infect people, but they will stimulate the immune system.

BARRIERS TO PHARMACOGENOMICS PROGRESS

The field of pharmacogenomics research is still in its early stages of development. Before many of the advantages of pharmacogenomics may be realized, a number of the following obstacles must be removed. They are listed below.

1. Complexity of finding gene variations that affect drug response

DNA sequence variations known as single nucleotide polymorphisms (SNPs) arise when a single nucleotide (A, T, C, or G) in the genome sequence is changed. The 3-billion-base human genome has SNPs every 100 to 300 bases, therefore millions of SNPs must be found and examined to ascertain whether or not they are involved in medication response. Our incomplete understanding of the genes involved in each medication response further complicates the procedure. Finding the overall picture of the effects of gene variants is quite difficult and time-consuming because many genes are expected to affect responses.

2. Limited drug alternatives

For a certain illness, there might only be one or two approved medications available. Patients may have no other choices for treatment if they have gene mutations that prohibit them from using these medications.

IMPACT ON PHARMACY PROFESSION

Currently, pharmacists provide information regarding side effects and drug-drug interactions, whereas doctors diagnose and prescribe medications based on trial and error. However, one day, gene reports will be used in place of blood reports.In order to ensure a speedy recovery, the pharmacist would analyze the genetic findings immediately following the diagnosis and provide the medication that would work best for your specific gene.

Summary of Computational Approach in Pharmacogenomics and Drug Development and Therapeutics

The effectiveness of cancer therapies is significantly influenced by drug delivery schedules; mathematical models of population dynamics and treatment responses may be employed to provide mechanistic insights and ideal drug administration regimens. The proper interpretation and bioinformatic processing of increasingly complex multi-omics data sets, however, present a significant barrier. Mutations in the coding sequence or expression of genes, as well as temporary reactions to external stimuli at the level of protein activity, posttranslational modification, stochastic processes, etc., have a significant impact on how biological networks function. Genomics is thought to be insufficient for research and medication development on its own.Therefore, an integrated systems pharmacy strategy may be used to link many one-dimensional biomolecular-omics data sets and patient history to enhance our understanding of the biology underlying diseases and drug-response phenotypes.

CONCLUSIONS

Pharmacogenomics in pharmaceutical industry is a potential tool, awaiting use for the maximum benefit. It represents a radical advance in medical history. The main aims of it are; personalized therapy, improvement in efficacy and reduction in adverse drug reactions, correlation of genotype with clinical genotype, identification of novel targets for new drugs, and pharmacogenetic profiling of patients to predict disease susceptibility and drug response. In the past, most drugs were designed to work on the population level rather than being targeted for the individual patient. By reversing that trend, pharmacogenomics helps to refine the focus of treatment and makes drugs more effective and less toxic. Rather than relying on

the outward manifestation of disease the signs and symptoms that physicians call the phenotype pharmacogenomic medicine examines and treats the genotype. Gradual inclusion of pharmacogenomic studies in drug discovery and development will cause substantial reduction in the expenses involved in drug development, ensure a safe clinical trial and reduce failures. Thus, many potential drugs which may be lost due to the effects on the outliers in a study can be retained when pharmacogenomic study is used in the future.

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