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Review on "PHARMACOGENOMICS"

[1]Dr. Preeti Kulkarni, [2]Tushar Ade, [3]Shraddha Kanade, [4]Akshay Rajput, [5]Dr. V.H. Bhaskar

[1]HOD & Professor of Pharmaceutical Chemistry, [2,3,4] Student, Dept. of Quality Assurance, [5]Principal

LSHGCT's Gahlot Institute of Pharmacy, Koparkhairane.

ABSTRACT

Pharmacogenomics is a field of pharmacology that examines how genetic variation affects a patient's reaction to a medicine by connecting a treatment's efficacy or toxicity to gene expression or single-nucleotide polymorphisms. In order to achieve optimum efficacy with a minimum of side effects, it strives to establish logical methods to optimize pharmacological therapy with respect to the patient's genotype. Such strategies signal the coming of personalized medicine, where medications and treatment combinations are tailored to each person's specific genetic profile. Pharmacogenomics, or "whole genome pharmacogenetics," is the study of how individual genes interact with medications. Understanding the advantages and disadvantages of novel genotyping technologies' potential utility for pharmacogenomics (PGx) is necessary for the ongoing development of these technologies.

Keywords: Pharmacogenetics; Singlenucleotide polymorphisms; Genomics; Genotype.

INTRODUCTION

Pharmacogenomics is the study of how a person's genetic composition influences how they react to medications. Finding genetic variants that affect medication metabolism, absorption, distribution, and excretion is part of the process. Pharmacogenomics seeks to create genetically-tailored, personalized therapy for patients. It could decrease adverse responses and dosing errors while increasing therapeutic efficacy and safety.

Pharmacogenomics is a branch of research that looks at how changes in a person's genetic make-up can affect how they react to medications. It blends pharmacological and genomics principles to develop individualized medicinal treatments that are tailored to a patient's particular genetic profile.

Today, with the aid of numerous treatment therapies, such as cancer chemotherapy and oral anticoagulants of the patient's pharmacogenetics state, to reduce the dangers and ineffectiveness of pharmacological therapy.

Historical background of pharmacogenomics

The concept of individual diversity in medication response was initially proposed in the early 20th century, which is when pharmacogenomics got its start. Here are some further details and a source: The idea of "magic bullets," or medications that may selectively target disease-causing pathogens while sparing healthy tissues from harm, was put forth in 1909 by the German physician Paul Ehrlich. He advocated for medications to be individualised to the patient's specific traits since he understood the significance of individual variability in drug response. The study of how inherited genetic characteristics affect drug response was the focus of the emerging field of pharmacogenetics in the 1950s and 1960s. The term "pharmacogenetics" was first used by AmoMotulsky in 1957, and he proposed that individual genetic variation may be the cause of some patients' unfavourable drug reactions

The term "pharmacogenomics," first coined in 1997, emerged as gene cloning progressed to the sequencing of the full human genome.

Genetic variationand drug responses

Genetic diversity can have a substantial impact on pharmacological response, resulting in individual variances in efficacy and safety. Variability in medication metabolism, absorption, distribution, and elimination is caused by variations in the genes implicated in these processes. Understanding these genetic variations can aid in the development of individualised medical therapies that are catered to each patient's particular genetic profile. Warfarin, a medication used to prevent blood clots, is one example of how genetic diversity affects pharmacological response. Warfarin's metabolism and activity can be affected by variations in the CYP2C9 and VKORC1 genes, and this can have a considerable impact on how each person responds to the medication. Genetic testing can assist identify patients who are susceptible to negative drug reactions and can help prescribe dosage changes to increase safety and effectiveness.

Targeted medicines are one application of pharmacogenomics in the management of cancer. These medications are made to target cancer cells specifically depending on the genetic abnormalities in those cells, preserving healthy cells and minimising side effects. For instance, the medicine trastuzumab, which particularly targets the HER2 protein that is overexpressed in these tumours, can be used to treat HER2-positive breast cancer.

The usage of clopidogrel, a popular antiplatelet drug used to prevent heart attacks and strokes, is another example of pharmacogenomics in cardiovascular medicine. However, genetic differences in the CYP2C19 enzyme, which breaks down clopidogrel, may result in diminished medication efficacy in up to 30% of individuals. Doctors can change the amounts of these patients' drugs or switch them to other ones, like prasugrel.

Pharmacokinetics vs pharmacogenomics

Two closely related disciplines, pharmacogenomics and pharmacokinetics, concentrate on how genetic variants affect drug response. There are distinctions in the scope and methodology of the two fields, which both investigate the connection between genetics and medication response.

Pharmacogenetics is the study of how changes in particular genes affect the response to drugs. The link between specific genes and drug metabolism, absorption, distribution, and elimination is the subject of this field. The CYP2C9 and VKORC1 genes in the case of warfarin are two examples of particular genetic variants that alter drug response that have been identified thanks to pharmacogenetics. On the other side, pharmacogenomics is the study of how a person's entire gene pool affects drug response. In order to identify genetic differences that affect drug response and to provide personalized medicine, this field studies the complete genome.

For governing e-pharmacies in India a substantial legal guidelines is need. To promote drug to the minor. Reach of era pushed version to uneducated humans because of lack of know-how approximately internet. Speed of internet. Prescription associated issue. Identity and consistency of immoral e-pharmacy. Safety of consumer right. Accessibility virtual signature. Shipping or sale of drugs to youngsters. Safeguard Of client rights .Privacy and confidentiality of details interchanged. Unclear suggestions and legal guidelines on inter-nation transfer of drugs Speed of internet,Prescription related, issues legality of electronic hand, Identity and trust ability of legal e-pharmacy, Protection of consumer rights.

Importance in healthcare

Pharmacogenomics is significant in healthcare because it has the potential to enhance patient outcomes by customising drug therapy based on a patient's genetic composition, Here are some further details and a source. Pharmacogenomics has the potential to decrease adverse drug reactions (ADRs), which are a major public health concern, and increase treatment efficacy. ADRs play a substantial role in many hospital hospitalisations and fatalities, as well as severe morbidity and lowered quality of life. Pharmacogenomics can assist in preventing adverse drug reactions (ADRs), lowering prescription mistakes, and enhancing patient care by discovering genetic differences that affect drug response. Additionally, by identifying possible therapeutic targets and forecasting drug efficacy, pharmacogenomics can aid in guiding the development of pharmaceuticals, which could result in the creation of more powerful medications.

Advantages

Pharmacogenomics enables the personalization of medication therapies based on a patient's unique genetic profile. This strategy can reduce unfavourable medication responses while improving the efficacy of therapies.

Drugs that specifically target the genetic alterations that cause disease have been developed as a result of pharmacogenomics. These medications have been demonstrated to be less harmful and more efficient than conventional chemotherapy.

Enhancement of Safety of Pharmacogenomics testing might help identify people who could be more susceptible to negative medication responses.

To reduce the potential of injury, the information might be utilised to modify dosages or choose alternate treatments.

Faster drug development: Pharmacogenomics can assist in the identification of drug targets and biomarkers linked to illness susceptibility and therapeutic response. This knowledge can expedite processes.

Disadvantages

Cost: Testing for pharmacogenomics and personalized medicine can be pricey, which may prevent some patients and healthcare systems from using them.

Pharmacogenomics tests are not accessible for all medications, which restricts the usefulness of this strategy to some illnesses or disorders.

Lack of Standardization: Pharmacogenomics testing currently lacks standardization, which might result in inconsistent results and make it challenging to interpret and implement the data.

Knowledge Gap: Much remains to be discovered about the genetic basis of medication response and illness susceptibility. For some illnesses, this may make it more difficult to design efficient targeted medicines or pharmacogenomics tests.

Ethical Issues: As was already said, using genetic information raises ethical issues such privacy and genetic prejudice.

Challenges implementing in clinical practice

Limited Evidence: For the utility of pharmacogenomics testing in clinical practise, there is a dearth of evidence. There have been numerous genetic variants identified as possible drug response predictors, however there are frequently not enough high-quality studies to support their usage.

Cost and Reimbursement: Testing for pharmacogenomics can be expensive, and insurance companies might not pay the charges. As a result, it may be more challenging to integrate pharmacogenomics into standard clinical practise and restrict patient access to testing.

Education and Training: Health care professionals must get education and training on how to analyse and apply the results of pharmacogenomics tests. The training programmes and educational resources needed for this must be heavily funded.

Ethical and Legal Issues: There are concerns regarding the ethical and legal aspects of genetic information

Application

Pharmacogenomics can be used to create medical treatments that are specifically suited to each patient's individual genetic profile. This method has been utilised successfully in the treatment of cancer, where genetic testing is used to identify patients who are likely to benefit from particular targeted medicines.

Pharmacogenomics can aid in identifying genetic variants that affect drug response and serve as a research tool for new medications. Pharmacogenomics can help create more effective medications with fewer adverse effects by finding genetic differences that alter therapeutic targets.

Predictive testing: Pharmacogenomics can assist identify which patients are most likely to respond to particular medications, improving treatment outcomes and lowering medical expenses.

For instance, genetic testing can indicate patients who will likely respond to antidepressants, which can assist inform therapy choices

Conclusion

In conclusion, the science of pharmacogenomics is expanding quickly and has the potential to completely change the way we practise personalised medicine. Clinicians can decide on medication dosages and treatment strategies for specific patients by using genetic data to predict therapeutic efficacy and toxicity.

This can enhance patient outcomes, lessen negative drug reactions, and eventually result in better healthcare overall. The necessity for genetic data interpretation and testing to be standardised, as well as concerns about patient privacy and ethical considerations, remain obstacles that must be overcome.

However, pharmacogenomics' advantages are undeniable, and more study and development in this area will undoubtedly result in even more significant improvements in personalised medicine in the future

References

1. Fiers W, Contreras R, Duerinck F, Haegeman G, Iserentant D, Merregaert J, Min Jou W, Molemans F, Raeymaekers A, Van den Berghe A, Volckaert G. Complete nucleotide sequence of bacteriophage MS2 RNA: primary and secondary structure of the replicase gene. Nature. 1976 Apr 8;260(5551):500-7.
2. Lee SY, Nam MH, Kim JS, Kim JW. A case report of a patient carrying CYP2C9* 3/4 genotype with extremely low warfarin dose requirement. Journal of Korean medical science. 2007 Jun 1;22(3):557-9.
3. Yong WP, Innocenti F, Ratain MJ. The role of pharmacogenetics in cancer therapeutics. British journal of clinical pharmacology. 2006 Jul;62(1):35-46.
4. Phillips KA, Veenstra DL, Oren E, Lee JK, Sadee W. Potential role of pharmacogenomics in reducing adverse drug reactions: a systematic review. Jama. 2001 Nov 14;286(18):2270-9.
5. Pirmohamed M. Pharmacogenetics: past, present and future. Drug DiscovToday. 2011 Oct;16(19-20):852-61. doi: 10.1016/j.drudis.2011.08.006. Epub2011 Aug22.PMID:21884816.
6. Malik NN. Drug discovery: past, present and future. Drug Discov Today. 2008Nov;13(21-22):909-12.doi:10.1016/j.drudis.2008.09.007.PMID:18852066.
7. Gaedigk, Andrea, et al. "The Pharmacogene Variation (PharmVar) Consortium: incorporation of the human cytochrome P450 (CYP) allele nomenclature database." *Clinical Pharmacology & Therapeutics* 103.3 (2018): 399-401.
8. Kirchheiner, J., et al. "CYP2D6 and CYP2C19 genotype-based dose recommendations for antidepressants: a first step towards subpopulation-specific dosages." *ActaPsychiatricaScandinavica* 104.3 (2001): 173-192.
9. Marsh S. Impact of pharmacogenomics on clinical practice in oncology. MolDiagnTher.2007;11(2):79-82.doi:10.1007/BF03256226.PMID:17397243.
10. Greenbaum, Dov. "Incentivizing pharmacogenomic drug development: howtheFDAcanovercomeearlymisstepsinregulatingpersonalizedmedicine."*RutgersLJ*40 (2008):97.
11. Pirmohamed, Munir. "Pharmacogenetics and pharmacogenomics." *British journal of clinical pharmacology* 52.4 (2001): 345.
12. Nebert DW. Pharmacogenetics and pharmacogenomics: why is this relevant to the clinical geneticist?. Clinical genetics. 1999 Oct;56(4):247-58.
13. Relling,MaryV.,andWilliamE.Evans."Pharmacogenomicsintheclinic."*Nature*526.7573(2015):343-350.
14. Ma,Hamburg."Thepathtopersonalizedmedicine." *NEnglJMed* 363(2010):301-304.
15. Relling MV, Evans WE. Pharmacogenomics in the clinic. Nature. 2015 Oct15;526(7573):343-50. doi: 10.1038/nature15817. PMID: 26469045; PMCID:PMC4711261.

16. Johnson, Julie A. "Pharmacogenetics in clinical practice: how far have wecomeandwherearewegoing?."*Pharmacogenomics*14.7(2013):835-843.

17. JohnsonJA.Pharmacogeneticsinclinicalpractice:howfarhavewecomeandwherearewegoing?Pharmacogenomics.2013May;14(7):835-43.doi:10.2217/pgs.13.52.PMID:23651030;PMCID:PMC3697735.

18. Crews, Kristine R., et al. "Pharmacogenomics and individualized medicine:translatingscienceinto practice." *Clinical Pharmacology &Therapeutics*92.4(2012):467-475

19. van der Lee M, Kriek M, Guchelaar HJ, Swen JJ. Technologies for pharmacogenomics: a review. Genes. 2020 Dec 4;11(12):1456.

20. Roses AD. Pharmacogenetics and the practice of medicine. Nature. 2000 Jun 15;405(6788):857-65.

21. Scott, S. A., et al. "Clinical Pharmacogenetics Implementation Consortium guidelines for CYP2C19 genotype and clopidogrel therapy: 2013 update." *Clinical Pharmacology & Therapeutics* 94.3 (2013): 317-323.