Review Article

Precision medicine: recent progress in cancer therapy

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Abstract

This review was aimed to describe a new approach of healthcare performance strategy based on individual genetic variants. Personalized medicine is a model for health care which is a combination of preventive, personalized, participatory and predictive measures. It is an approach for a better treatment by identifying the disease causing genomics makeup of an individual. This work features key advancements in the improvement of empowering advances that further the objective of customized and precision medication and the remaining difficulties that, when tended to, may produce phenomenal abilities in acknowledging genuinely individualized patient consideration. Customized treatment for patients determined to have strong tumors has brought about a few advances as of late. To improve a multi-drug approach ready to coordinate DNA and RNA adjustment, proteomics and metabolomics will be essential. The execution of translational examinations dependent on fluid biopsy and organoids or xenografts to assess molecular changes because of clonal weight produced because of the utilization of target specialists or tumor heterogeneity would help in the recognition of systems of opposition, proposing opportunities for novel mixes. The investigation of massive data in oncology can profit altogether from being engaged by artificial intelligence and machine learning strategies.

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Introduction

Personalized medicine is a special strategy which refers to a tailoring of clinical treatment for the individual characteristics of patients. These drugs are made based upon the genetic setup of the human genome. It becomes the fundamental difficulty for the diagnosis, prevention and therapy of any disorder and personalized medicine is based totally on the pharmacogenomics and genomics. Personalized medicine is a model for health care which is a combination of preventive, personalized, participatory and predictive measures. It is an approach for better treatment by identifying the disease causing genomic makeup of an individual. Personalized medicine is a broad field and it can be used for the diagnosis of various diseases like cancer, Alzheimer, hepatitis, cardiac diseases etc. Precision medicine according to the National Institutes of Health (NIH), precision medicine is "an emerging approach for disease treatment and prevention that takes into account individual variability in genes, environment and lifestyle for each person" [1]. On January 30, 2015, US president, Obama, declared subsidizing for an Initiative in Precision Medicine [2]. After three years, National Academy of Sciences Board of Trustees report clarified exactly how an activity could quicken progress in clinical consideration and exploration [3]. This methodology will allow doctors and investigators to anticipate more definitively which treatment and anticipation techniques for an extraordinary disease will work at gatherings of individuals. It is in conflict with a one-size-fits-all approach in which infection treatment and prevention strategies are produced for the normal

individual, with less thought for the contrasts between people. Despite the fact that the expression precision medicine is generally new, the idea has been a piece of medical service for a long time. For instance, a person who requires a blood transfusion is not given blood from a randomly selected donor; instead, the donor's blood type is matched to the recipient to decrease the risk of complications [4]. In spite of the fact that models can be found in a few zones of medication, the work of accurate medication in everyday medical care is generally restricted. Scientists believe that this methodology will extend to numerous zones of well-being in the coming years. To be sure, precision medication is presently broadly used distinctly in oncology [5], especially for the therapy of melanoma, metastatic lung, breast and brain malignancies and leukemia. Radio iodine is a regular design of precision medication and has been used generally for the administration of separated thyroid malignant growth [6]. Medication has not yet got a clinical norm for some conditions not withstanding its exclusive standards in the United States, Germany and other different countries. Between the terms precision medication and personalized medication, there is a lot of overlap. As indicated by the National Research Council (United States), personalized medicine" is an older term with significance like precision medication. There was worried that the expression customized could be confused to suggest that medicine and anticipation are being progressed remarkably for every person in the correctness of medication, the attention is on distinguishing which approaches will be successful for which patient's dependent on hereditary, ecological, and way of life factors [7].

Empowering technologies for precision medicine

The field of precision medication has just given significant experience into the components at play in the disease beginning with organic focus on that can straight forwardly restrain infection movement and into bio markers that reflect the treatment response. Such agreement has 'aggregately' interfered with considerable advances towards improving patient treatment results [8]. With new information sources and mix of this information, precision of medication will drive existing medication choice stages like 'pharmacogenomics' and patient-derived primary cultures [9]. At the point when combined with enormous information stages, these methodologies can distinguish focused on treatments that may anticipate as well as initiate improved reaction rates over clinical principles. Significantly, these advances are in effect effectively measured in a clinical setting. One investigation of cellular breakdown in lungs of patients is matching genomic examination of murine and human examples and coupling this information with imaging examination in a clinical preliminary to recognize genomics marks to improve fluid biopsies. An accuracy-guided investigation for treating malignant growth is being directed, where patients are screened for the cytochrome p450 2D6 (CYP2D6) and μ-narcotic receptor (OPRM1) genotypes to screen their reaction to narcotic treatment. Precision medication is being utilized to distinguish genomic and molecular markers to predict the persistent reaction to the organization of 17-hydroxyprogesterone caproate (17OHPC) [10].

The revolution of tumor treatment

The idea of precision medication can be apparently gone once again in the 1960s when such drugs were presented unexpectedly through the idea enveloping the term 'pharmaco-genetics'/'pharmaco-genomics' by Evans and Clark [11]. With the coming of high-throughput information produced through next generation sequencing (NGS) technologies, the term started transforming from systems medicine' or 'systems biomedicine' to 'precision medicine' and 'personalized medicine' [12]. Subsequently, with more genome level information investigation and frameworks, biological data pouring in wording like 'Genomic-era medicine' [13]. P4 systems medicine' and 'Computational systems biomedicine' were referred to a similar idea.

This includes mediation treatments incorporating the effect of any quality of people and their introduction on the way of life and climate. In spite of practically comparable considerations, Precision medicine' and 'personalized medicine' differ clearly [14]. Mentionable among them is malignancy, which showed multiplying helplessness before the unremarkable adequacy of prior created drugs, fundamentally because of its heterogeneous causes [15].

In this unique situation, a detailed all-inclusive methodology has been endeavored for recognizing novel malignancy qualities and proteins which upon the drug focusing on, would offer a rise to the results [16]. In short, high repetition of chromosomal alterations has been seen in various malignancy types.

These incorporate movements of chromosomes, strengthening and cancellation occasions, and transformations just as stretching of telomeres [17].

Different occasions of genomic instability, emerging from disabled DNA twofold strand break (DSB) fix, have been demonstrated to be brought about by SPOP (Speckle type POZ protein) transformation in prostate disease. Further moments of knowledge on clonal transformations of proteins like L1 cell attachment particle (L1CAM) and APOBEC are acquired for carcinoma [18].

Accuracy molecular oncology: understanding the role of new drivers with novel drugs

One of the most prevalent molecular alterations in solid tumors are PIK3CA mutations. The PI3K/AKT/mTOR (phosphatidylinositol 3-kinase (PI3K)/AKT/mammalian objective of the rapamycin (mTOR)) pathway is an intracellular weakening pathway involved in cell proliferation. This pathway can be activated at several points, but PIK3CA changes and PTEN (phosphatase and tension homolog function loss are the most frequent detectable molecular alterations [19].

For this reason, several basket trials have been conducted or are still ongoing to assess the role of PIK3CA inhibitors in several solid tumors. In breast malignancy, the occurrence of PIK3CA mutations+ is about 30% in essential tumors and metastases [20].

Impediments of molecular driven treatment in the clinic

Limitations of the molecular approach, another point that should be addressed is the evolution of the specific molecular tools used for the selection of patients enrolled in the clinical trials. In some precision medicine-based trials, patients were screened by 'immunohistochemistry' (IHC). The use of a total Next Generation Sequencing (NGS) board able to assess a wide screen of molecular alterations is very normal. The investigation performed by NGS or RNA sequencing gives high 'affectability' in the location of explicit molecular alterations and also the capability of detecting concomitant alterations that could cause eventually resistance to specific targeted agents [21, 22].

Instructions to overcome limitations of functional precision medicine

Patient-Derived Organoids (PDOs) and xenografts in a personalized approach, to functional precision cancer medicine have the potential to complement current genomic approaches. The minor role of molecular profiling in predicting response to targeted therapies and limitations of preclinical models currently used for drug selection have hindered correct validation of precision medicine [23]. Persistent determined xenograft (PDX) models have contributed in performing translational medication.

These models are got from the transplantation of patient tumor cells into immune deficient mice. These models were found to repeat in a more comparable manner the first tumor attributes versus past models In-vivo. PDXs monitor the original tumor characteristics preserving the heterogeneity. PDXs could help in predicting drug sensitivity and resistance in several tumor types, being a good tool to improve personalized approach [24, 25].

Dynamic evaluation of tumors

The liquid biopsy is yet another promising tools that has enormously encouraged unique assessment of solid tumors is plasma without cell DNA (cfDNA) examination by liquid biopsy. Although a particular targetable biomarker can be recognized, resistance always appears. Therefore, the assessment of tumor heterogeneity and clonal determination of treatment compelled should be profoundly described. A few arrangements have recommended that cfDNA could assess tumor heterogeneity by identifying the molecular components of procured obstruction [26, 27]. This investigation permits genomics and other molecular changes to be assessed at a specific moment, leading to the accurate evaluation of tumor development.

Present quality and future guarantees of customized medication

The prospects that are intended for information concentrated, predictive and systems biomedicine are various and implanted inside more extensive logical casings, yet there are additionally covering subjects that cross starting with one future vision then onto the next, yet they show to some degree distinctively in manners that reflect relevant differences and various plans. However, inside the approach talks, both precision and customized medication activities are likewise entrapped with guarantees of another model of residents and public cooperation, imagined as active and collective with medical care and examination experts, policymakers and administrative bodies [28, 29]. Since an aggregate character or feeling of having a place has been taken as fundamental for a powerful shared administration, a manner of speaking of European personality and European citizenship is inserted in the EU structure which additionally shapes how moral duty over well-

being is decrypted with regard to European medical services for residents of the European Union [30]. Pharmacogenomics is a promising field but it's the best method to create new targeted therapy for any disease. Because of this approach we will get accuracy in the treatment and the chances of side effects will also be reduced. This could be a better way to reduce the cost and time required to develop new medicine. The FDA has already approved so many medicines and in the future also it will approve based on their novelty. This therapy is a combination of clinical and family history which offers the exciting and novel tool for drug development. So, the personalized medicine can be a better approach for early detection and cure of diseases but for these people or future physicians should be responsive and active towards the work so they can easily face the challenges and make this approach feasible to all.

What kinds of medical tests are available?

A large number of clinical tests dependent on different innovations can be performed to help us answer these inquiries. Other than the tests that have been utilized for quite a while, there are some relatively newcomers, such as advanced imaging technologies (e.g., magnetic resonance imaging). Genomics is of specific importance with regard to personalized medicine [31]. As noted before, the development of the term personalized medicine coincided with the Human Genome Project and other initiatives in that period, such as the single nucleotide polymorphism consortium. For individuals with a malignancy analysis, their tumor may be tried for particular kinds of gene changes or proteins produced using those gene changes. This testing can give data about how their disease develops and spreads. These tests may be called biomarker tests, chromosome tests, quality tests, or biochemical tests. It might be done using a blood or saliva sample, biopsy tissue, or body fluids. If the test is done using a biopsy sample (from a tumor), it's done in a special lab and might be called by different names, such as DNA mutational analysis, genomic testing, proteomics, biomarker testing, tumor profiling, cytogenetics, next generation sequencing, or molecular testing. In some cancers, the gene testing done on a tumor can affect treatment choices. This is because certain gene changes can affect how a tumor responds to certain treatments and some tumors have gene changes that are different from other tumors of the same type. For example, not every melanoma skin cancer will have the exact some gene mutations. This means these tumors might not respond to a treatment the same way. The goal is to give a treatment that can target a gene mutation without causing too many side effects, and to avoid giving treatments that might not work. Two types of treatment often used in precision medicine: Targeted therapy and Immunotherapy.

Medical decisions involved in personalized medicine

A test frequently educates treatment choices that eventually improve the patient. In the first place, a clinician can utilize a test to choose whether or not a patient will profit from a specific medication. As noted before, the choice to utilize trastuzumab can be helped by the aftereffect of the HER2 test. A positive test result can be taken to mean that trastuzumab will be sufficiently effective for that patient, while a negative test result can be taken to mean that the treatment will not be sufficiently effective. At the point when the molecular objective of a medication is all around characterized and explicit to the causal pathway of the infection, the combination of test treatment might be referred to as a targeted therapy [32]. Since the activity of these medications is unique in relation to that of conventional cytotoxic medications utilized in clinical oncology, in which disabling indiscriminate cell replication, the need is that focused treatments will be more explicit for the hindrance of tumor development and will have fewer results for material patients. In different cases, the test can help decide if the patient will be bound to have a genuine unfavorable occasion subsequent to being given a medication and an illustration of this kind of test can be found in the second-line treatment of constant myeloid leukemia, where the effectiveness of candidate treatments such as dasatinib and nilotinib may be predicted before initiating treatment [33].

Machine learning approaches for personalized cancer therapy

The significance of collection malignancy patients into high or generally safe gatherings has driven many examination groups from the biomedical and, therefore the bioinformatics field to anticipate the use of AI (ML) techniques. Hence, these strategies are used as expect to display the movement and therapy of carcinogenic conditions. Variety of those procedures, including Artificial Neural Networks (ANNs), Bayesian Networks (BNs), Support Vector Machines (SVMs), and Decision Trees (DTs), are generally applied in disease research for

the advancement of prescient models, bringing about powerful and precise dynamics [34]. The HCI-KDD approach, which may be a synergistic mixture of techniques and approaches of two regions, Human Computer Interaction (HCI) and Knowledge Discovery and data processing (KDD), offers ideal conditions towards settling these difficulties with the target of supporting human insight with machine insight [35]. A significant test in disease therapy is anticipating the clinical reaction against malignancy drugs on a customized premise. Sakellaropoulos *et al*. showed and gave a symbol of idea to the use of profound neural organization (DNN) - based structures to assist precision oncology methodology [36].

The investigation of enormous data in oncology can profit altogether from being engaged by AI (ML) strategies [37]. ML is usually characterized because of the investigation of algorithmically collected numerical models that are fitted for the part of information called the preparation dataset, to form forecasts for the correspondingly got and likewise organized information called the test or approval dataset. Borisov and Buzdin applied ML for customized medications, principally oncology, managing endeavours to supply, however very much like could reasonably be expected treatment reaction biomarkers from average datasets as explained in **Figure 1**.

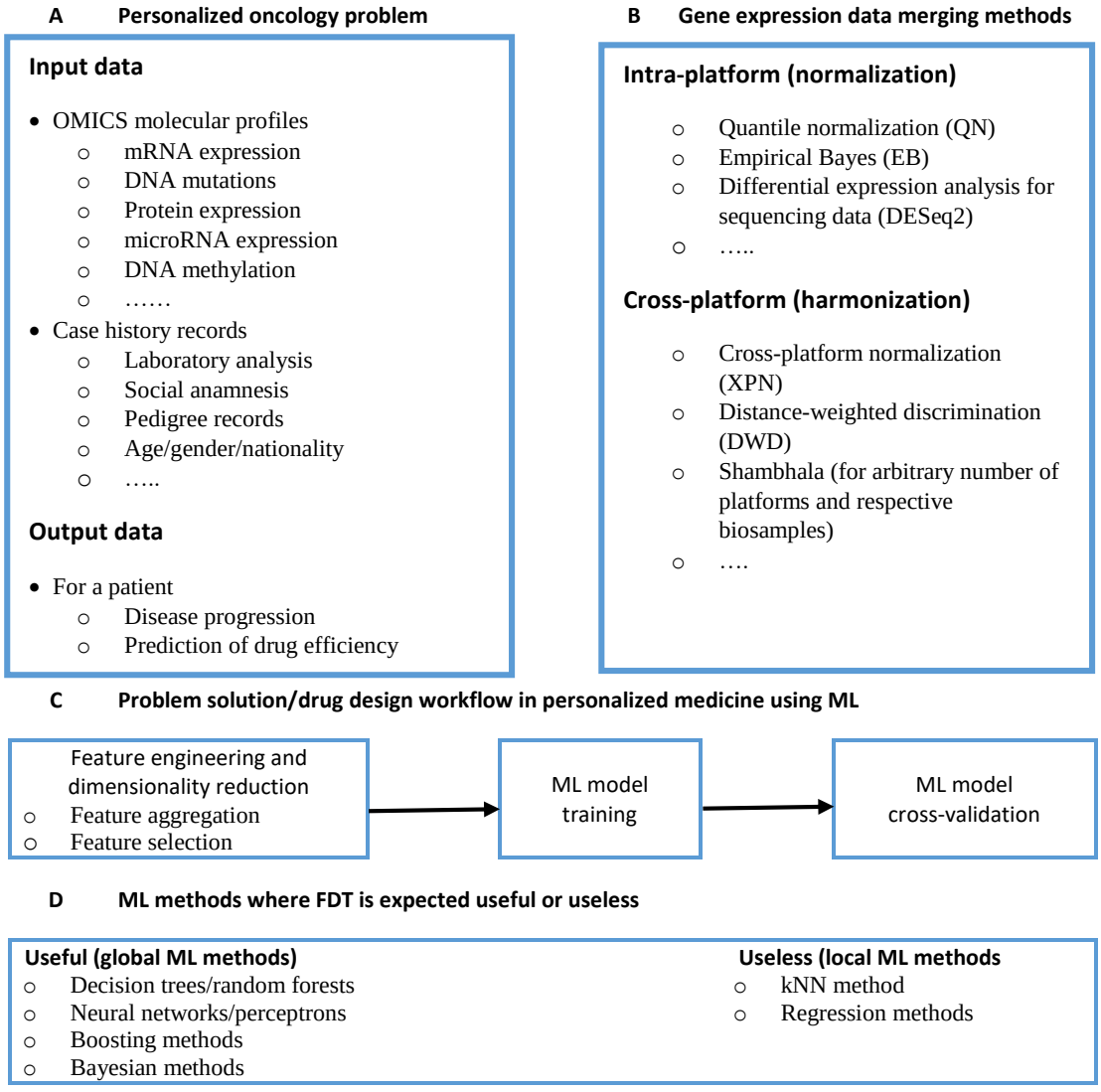

Figure 1: Input and output data types (A) methods for feature harmonization (B) general workflow (C) for a ML-assisted solution of typical problem in personalized medicine; ML methods for those FDT is expected to be useful or useless (D). [Reproduced from ref. 38]

Conclusion

Customized treatment for patients determined to have strong tumors has brought about a few advances as of late. The possibility of offering a molecular-based customized approach for malignancy patients speaks to an appealing chance in oncology. To get a relevant and genuine change which could improve all clinical results, a greater understanding of molecular science is required. To improve a multi-omics approach ready to coordinate DNA and RNA alteration, proteomics and metabolomics will be essential. The implementation of translational examinations dependent on fluid biopsy and organoids or xenografts to assess molecular changes because of clonal weight produced because of the utilization of target specialists or tumor heterogeneity would help in the recognition of systems of opposition, proposing opportunities for novel mixes.

Machine learning for customized medication, principally oncology, managing endeavors to supply, however, very much like could reasonably be expected treatment reaction biomarkers from average datasets.

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Conflict of Interest

All authors declare no conflict of interest.

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