

Cancer Genomics: An approach to personalized therapy

-Yama Atri

University of Delhi South Campus

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-Yama Atri, Research Scholar, AN lab, UDSC.

Every disease deadly or otherwise requires immediate medical attention. It helps if we know what we are treating and how we would proceed. The progressive nature of the ailment warrants prompt response but all is lost in the hurriedness of curing it. This calls for the development of such technologies that can not only tell us beforehand the predisposition of a person to a disease but also aid in giving out the best treatment possible. Cancer, an aberration borne out of uncontrolled proliferation of cells is one such disease that has poor diagnosis and an even poorer prognosis. Even after its detection, there is no guarantee that the therapy given to the patient would completely work. A matter only made worse by the genetic diversity of the patients being treated and of the different types of cancer itself. This is where cancer genomics steps in.

The beginning-Cancer Genomics

Ever since the discovery of DNA by Watson and Crick in 1951 a lot of work has been dedicated in understanding the instructions or chemical codes that directs the cell what to do. These codes, when changed due to additions, deletions or other modifications lead to abnormalities like cancer. The Human Genome Project spearheaded by Craig Venter has provided the scientific community a way of studying the entire blueprint that we are made of, enabling not only the screening but also comparison between the genome of an individual having tumor with a normal DNA in its entirety. It is further aided by high throughput molecular profiling approaches that have recently come up. Such researches carried out with genomics approach, because cancer always has some genetic link, would no doubt equip the doctors/ clinicians better in treating the patients, thereby paving the road to a more personalized care which is individual-centric and focuses on a patient's genomic landscape. Cancer genomics, the study of the genetic alterations occurring in cancer, may provide us with crucial molecular signatures to answer questions such as 'whether the person is at risk of developing cancer' or if he already has cancer, 'what would be the prognosis or treatment efficacy of a regimen', 'would the patient suffer relapse' or 'would the cancer morph into a metastatic one?'. It would also help to illuminate the heterogeneities in cancer, the varieties in tumor cell lineages and populations that may be rare as well as their mutational rates. All this information may be instrumental in developing effective personalized/precision medicine.

The success-Cancer Genomics

Biotechnology experts would agree that there's still a long way to go for personalized care in cancer. A drug developed after genomics analyses and any drug for that matter would take a decade or so for completing its journey from bench to bed side which would not only involve receiving approval of the concerned medical authorities but also has to come out positive in rigorous clinical studies that would be performed. Nevertheless, genomics based study is proving to be immensely helpful in medical research and some diagnostic and screening tests are available. Increasing advancements in pharmacogenomics is also playing a critical role in coming up with safe and effective drugs and doses for patients. Various companies like Illumina, have been teaming up with researchers to use genome sequencing for discovering biomarkers for a variety of cancers like ovarian, gastric and colorectal. Research in genomics would require huge investments and governments of rich countries particularly will have to come forward to provide funds for these researches. For example in 2016, British Columbia has declared that it would provide 3 million dollars for cancer genomics research.

A recent article in CBC News tells us how Jen Strack a 41 year old lady from British Columbia, who was suffering from stage 4 lung cancer, was given personalized onco-genomics (POG) based treatment. She had no history of smoking. She was administered a drug that would not have normally been given to her but genomic profiling indicated that the drug may just work and it did. The same article further states that nearly 350 cancer patients also received such treatment there.

The future-Cancer Genomics

Despite the success stories and positive feedback received by this approach of personalized medicine, there are certain points that need to be considered. First of all, the previously mentioned POG based treatment was successful in only those cases where the target gene was identified. Therefore, it is going to be a tremendous challenge to determine a target gene for every cancer patient. Also as far trials involving POG are concerned it would be essential to obtain clearance from the ethics committee, certification for the techniques that would be used for testing patients as well as getting the informed consent of the patients undergoing trials. While genomics based researches appear to be providing effective treatment, phenomenon such as intra-tumor heterogeneity and clonal evolution would also need to be investigated. However, by employing a multidimensional approach incorporating the sequencing of not only the genome but also of the exome and the transcriptome we may be able to unravel and ultimately treat cancer and its accompanied complexities. This is important because epigenetic, transcriptional and protein alterations as well as modifications may add to the diverse genomic and phenotypic repertoire of cancer cells. Such knowledge would play a crucial role in understanding phenomenon like EMT, metastasis and chemoresistance that occur in cancer. Of importance is also to distinguish and validate genuine biological variations/alterations from technical errors that arise from genomics based studies such as Whole Genome/Transcriptome Amplification

techniques that may be used prior to sequencing. This would be crucial in order to prevent any misinterpretations arising due to artifacts, something which would be overcome in the coming years with the rapid developments and innovations that are being made in the field of technology.

Personalized medicine may develop to be a successful solution overcoming the limitations of one-dimensional analysis. However, such an endeavor would be even more beneficial if the results of the tests done on patients are provided in a clinically relevant time frame and that too at reasonable costs. Nevertheless, it seems inevitable that in the age of things being custom made, it won't be that far when treatments tailor-made to a patient's genome would eventually come into practice.