Triple-Negative Breast Cancer and Recent Advancements in Treatment

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Description

Cancer is a major disease imposing a major burden on the socio-economic status of the patients. With recent advancements in genome sequencing and analysis early diagnosis with identification of novel biomarkers and assessment of various cancer types has improved [1,2]. Apart from genomics, a combinatorial proteogenomic approach is also practiced to gain better insights on cancer biomarkers [3]. Along with this computational biology has aided research with new tools like machine learning based decision support system as a prognosis for cancer [4].

Breast cancer has four molecular subtypes which are predominantly based on genes involved. Triple Negative Breast Cancer (TNBC) is considered as an aggressive tumour which lacks progesterone and estrogen receptors along with human epidermal growth factor 2 protein. TNBC in particular is associated with frequent recurrence and chemo resistance. Till date no clear consensus has been achieved as a standardized care for TNBC.

15 drugs are currently in research/trials for chemotherapy against TNBC. Among the existing therapies, the common class of agents consisting of taxanes and anthracycline are in treatment regimens [5]. Apart from the regular chemotherapeutic regimens new modes of treatment are under clinical trials.

With the aid of technology, the drug discovery process has also taken a leap in discovering novel drugs both synthetic and natural derivatives. Anti-metabolite based GEICAM trails with adjuvant Capecitabine after standard neo-adjuvant chemotherapy in clinical trials stage III. The disease free survival rate was found to be low in the trails. On the similar lines, Create X trial a randomized phase II trial has reported an increase in disease free survival rate. These anti-metabolite-based drugs target the DNA synthesis pathways are proving to be crucial in treatment of TNBC. Novel therapies include immunotherapy and platinum-based therapy which are either in phase II or phase III clinical trials and have shown great confidence [6-9].

In the current research scenario, a lot of research groups are focused on application of natural or natural derivatives for treatment against TNBC. All the research till date are *in vitro* in nature and no human trials have been performed to determine the efficacy against TNBC. The current status of research is 21 natural compounds targeting eight out of ten biochemical chemical pathways. Wnt/β-catenin pathway was recently reported to be a potential target with a targeted coumarin derivative anti-TNBC activity [10,11]. This domain of research is now being promoted both by government funding agencies and private pharmaceutical sector.

For future prospects, research advancement has to occur in targeting the specific organs of interest than the biochemical pathways to optimize the effectiveness of the specific natural compounds. The synergistic effect of naturals has to be explored in the preclinical stage for enhanced anti-cancer activity.

The global research community emphasizes on novel targets along with naturals as an effective treatment regimen. The role of computational biology is of high importance in drug discovery research. High throughput screening, pharmacophore analysis, QSAR based robust pipelines have been set and are being optimized with respect to application of force fields. Handful numbers of commercial and open source software's are available to achieve the same. A research consortium of computational biology, biochemistry and validation teams is crucial to achieve development of effective anti-TNBC compounds.

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