Anticancer Drug Development, Pharmacology Updating

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Abstract

Anticancer drug development is facing new challenge-including areas of biomedical knowledge, medicinal chemistry, pharmaceutical technology and cancer pharmacology. Many past obstacles and dilemma continue to grow. A huge number of chemicals or bio-agents are waiting for pharmacological evaluation and mechanism study. Pharmacology quality and efficacy promotion may be useful for anticancer drug developments. To update drug development system, past convention must be reshuffled in the future. This Article provides this area of pharmacology updating in anticancer drug discovery, design and developments.

Keywords: Anticancer Drug Development; Pharmacology; Neoplasm Metastasis; Pharmaceutical Technology, Drug Combination; Cancer Stem Cells; Palliative Treatment

Background

Cancer is a malignant and mystery disease that costs life of millions annually worldwide. Current cancer therapeutics is lack of effective anticancer drugs and drug selective systems in the clinic [1-5]. As a result, the convention of drug discovery, development and manufacture needs quality promotion in both chemistry and pharmacology [6-11]. Over the past two decades, the evaluative systems of anticancer drug developments improved insignificantly [12,13]. For this reason, new proposals for most disciplines are proposed [12,13]. Correspondingly, the pharmacological and biomedical study for drug development is discussed in following sections.

Current challenges

After a great promotion of chemistry and genetic engineering techniques, much more new chemicals and bio-agents are waiting for pharmacological evaluation and mechanism exploration. As huge numbers of chemicals, bio-agents and herbal drugs are produced, pharmacology quality and efficacy promotion may be useful for anticancer drug developments. To update drug development system, past convention must be reshuffled or even breakdown in the future.

Key biological or pathological machinery that leads to clinical therapeutic failures, such as neoplasm metastasis (unpredictable nature), enigma of cancer stem cells and drug resistance (after long-term drug utility and tumor evolution) are still unresolved up to now [12-18]. In order to achieve better evaluative outcomes in this area, different platforms and strategies need to be updated.

Multinational cooperation and projects

Owing to highly economic investments and revenue shrinkage for anticancer drug discovery and developments, expanding global participation is quite necessary-including broader range of experts (medical chemists, pharmacologists and clinical doctors) for drug

developments [19]. New genomic data explosion by modern DNA sequencing for genetic pathways and network are used to greater number of normal people and cancer samples/patients [20]. It needs time to consume and ethical safeguards [21].

Pharmacology for anticancer drug development

A great diversity of cancer models

Different types of animal or human tumor modality is suitable for different anticancer drug evaluations (wide-spectra and narrow-spectra). Facing with this enormous tumor models, proper budget regulatory systems may be a way to control budgets [19].

Drug evaluative system streamlines

There is a enormous evaluative models in drug developments. In the past, anticancer activity is the only parameter for entering into further evaluation. More recently, this pharmacological doctrine is facing new challenge. Many other types of agents or drugs can improve anticancer activity by the strategy of drug combination. As a result, tumor models are not the only system for anticancer drug evaluation.

Different tumor inoculation routes may affect the outcomes of new compound responses/efficacy in experimental identifications and clinical evaluations. Common *in vivo* tumor models can be transplanted by various systems, such as subcutaneous locations (sc), intraperatoneal (ip), intravenous (iv), hollow fiber (hf), ectopic tumor origins or xenografts from human cancer tissues, organoids and patients derived xenografts [19,22,23]. Different tumor origins may obtain different types of anticancer agents. Similarly, environmental factors, surroundings and neo-vasculature can facilitate tumor survival and seeding into distant sites [24-27]. Correspondingly, anticancer pharmacology are waiting for evolutionary actions and updating [28].

Antimetastatic agents or drugs developments need to be greatly promoted because 90% cancer mortality is from neoplasm metastasis [29-34]. Current antimetastatic drug development is imperfect. Good selection of different metastatic models for various antimetastatic drugs is quite necessary. Deeper biomedical knowledge generation and insights can support new pharmacological studies and make it a great difference.

Herbal medicine

In anticancer drug development study, medicinal chemistry plays key role. After medicinal chemistry study, we can find effective agents as early as possible. After medicinal chemical and pharmacological study, it is obvious that natural chemotherapeutic drugs are many times more effective and less toxicity in cancer treatments [35-41]. Thus, developments of natural chemotherapeutic drugs will be a great pharmaceutical topic in future.

Discipline merge

Drug development is widely divided by different disciplines (neural, immune, cardiovascular, infection and others). This leads to great repetition and loss of opportunity. In order to overcome this low efficiency of drug development, breaking barriers of different stream of scientists is suggested. In addition, drug development must well cooperate between chemists and pharmacologists.

Mathematical models

Economic burden for pharmacological evaluation of anticancer drugs is increasing. How to change this situation, mathematical or computational network is hopeful. Computational design and analysis of experimental and clinical data can help predicting possible effective agents without any initial or further drug activity evaluations [42]. It can save times for anticancer drug developments. It needs to welcome mathematical or physics-majored researchers to join in [43-45]. Parallel to human tumor model innovation, avant-garde experimental equipment and lab facilities may improve the anticancer drug evaluation qualities, shorten evaluating courses, and make drug evaluations more precisely in the clinic. Generally, rapid technological advancements (tumor models and screening automation) help a great deal. Overall, we welcome all positive advancements of biomedical technology into anticancer drug developments.

Drug combination

Cancer is a malignant disease (multiple causality and steps-genetic and non-genetic) that is often difficult to be managed by single therapeutic drug and option. To overcome these obstacles, anticancer drug combination is a useful way to improve therapeutic outcomes in clinical cancer trials. Obviously, it did not do very well in the past. These kinds of efforts need long-term hard work and sustainable governmental support. It needs shortcut and larger assessment experimentally and clinically in future [46-48]. We shall not overlook these kinds of biomedical study.

Palliative drugs

There is no fixed therapeutic model for all cancer treatments. Among the past decade, palliative treatments for cancer are gradually accepted in global basis [49-51].

Pharmacological models for palliative treatments

Categories	Current	Future
Animal models	Mice	Large animals
Drug targets	Anti-proliferative	Antimetastatic
Tumor origin	Primary	Cancer stem cells
Drug efficacy	Single	Drug combination
Mechanisms	Tumor-oriented	Immune-oriented

Table: Future trends of anticancer drug developments.

Conclusion

Owing to the slow progresses of anticancer drug discovery and development, pharmacological updating can be made to facilitate drug development and cost reduction. In the future, much therapeutic efforts may be implemented.

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