Advances in Pharmacoepidemiology & Drug Safety

Lu et al., Adv Pharmacoepidemiol Drug Saf 2016, 5:1
DOI: 10.4172/2167-1052.1000e138

Editorial Open Access

Anticancer Drug Combinations, Studies for All Possibilities

Lu DY[1]*, Chen EH[2], Lu TR[3], Wu HY[3] and Ding J[2]

[1]School of Life Sciences, Shanghai University, Shanghai 200444, PR China
[2]Shanghai Institute of Materia Medica, Chinese Academy of Sciences, Shanghai 201203, PR China
[3]College of Science, Shanghai University, Shanghai 200444, PR China.

Abstract

Most cancer therapies are seldom effective by using single anticancer drug therapeutics based on multiple tumor genetic alterations and molecular abnormalities. Drug combinations are commonly practiced in clinics. Yet, anticancer drug combination utilities need to transform from empirical to science-guided enterprises. This editorial offers the background knowledge of drug combination therapies by mathematical enquiry.

Keywords: Drug combination; Mathematics; Cytotoxic anticancer drugs; Cancer stem cell; Personalized cancer therapy

Introduction

Cancer is a common disease that claims life about 7-10 million people annually in the world. As a result, cancer remains to be a great medical challenge worldwide [1,2]. Many efforts can impact on overall therapeutic outcomes in cancer patient treatments, especially in late-staged ones. One of these efforts is anticancer drug combinations. Long before, it was widely accepted that anticancer drug cocktail instead single drugs usually improved the therapeutic efficacies greatly [3-10]. Despite its great popularity and as a modern cliché, how to prescribe the effective and beneficial anticancer drug cocktails are emerging problems and must be solved in future. Since few anticancer drug combinations modular have been subjected for mechanism investigations, anticancer drug cocktail designs need to transform from empirical decision into science-guided modern predictive systems. Only by science-guided strategy, cancer drug combinative therapy can make great difference in most clinical settings.

Method

Different modular of anticancer drug combination strategies

Since no central dogma of anticancer drug combinations suitable for all cancer patients has been found, some propositions should be made first.

Previously, combination utilizations of cytotoxic anticancer chemicals with biotherapy or other therapeutic means are good strategies for cancer treatments [8-11]. Many similar examples are given later and will be discussed one by one. Several modular of anticancer drug combination systems are temporarily classified [10].

Mathematics of anticancer drug combinations

Since 178 anticancer drugs have been licensed worldwide [12], mathematically, huge numbers of drug combinations can be used.

According to mathematic equation (calculation for 3 anticancer drug combinations):

$$C = (178 \times 177 \times 176) / (1 \times 2 \times 3) = 924176$$

It means there are 924176 possibilities must be studied in clinical situations. At present, we cannot compare all these combinational possibilities easily in lab and in clinics. Yet we can imagine that these different types of therapeutic efficacy comparison data will be finished according to the rapid progresses of automatic or computerized experimental investigations within 10 years. These types of experimental drug combination evaluations should be encouraged.

Two strategies can be speculated to solve this problem.

1. Assessments of drug combinational possibilities with equal attentions. This strategy is labor-intensity and needs a long period of time for large-scale experimenting and complex data analysis/statistics.

2. Discover good anticancer drug combinations and relationships step by step. For example, we may identify and verify drug combinational possibilities by using one in each drug category first. Then, gradually enlarge anticancer drug numbers and mechanisms of action on this field of anticancer drug combinational studies. Like anthrocycline, camptothecine and other series of anticancer drugs can be screened by one anticancer drug in each drug categories.

We suggest that these anticancer drug combinational studies must be focused on *in vitro* anti-proliferative studies for limiting on 1-3 tumors cell lines first. Higher levels of anticancer drug combinational paradigms can be assessed based on *in vitro* anticancer drug activity evaluations. If this is the case, we can achieve gradually and cost less.

Discussion

Technical concerns

To perfect anticancer drug combination study, many new ideas and techniques must be invented. For example, excellent automation techniques are the top priority. Growing joint-venture activities and projects might finally help to overcome cancer mortalities in future.

Mathematician and physical-majored talents

Owing to the huge numbers of drug sensitive or anti-proliferative activity testing data, mathematic or statistics analysis for these large data ought to be equally participated by mathematicians or physics-

***Corresponding author:** Dr. Da-Yong Lu, School of Life Sciences, Shanghai University, Shanghai 200444, PR China; E-mail: ludayong@shu.edu.cn

Received January 02, 2016; **Accepted** January 06, 2016; **Published** January 08, 2016

Citation: Lu DY, Chen EH, Lu TR, Wu HY, Ding J (2016) Anticancer Drug Combinations, Studies for All Possibilities. Adv Pharmacoepidemiol Drug Saf 5: 138. doi:10.4172/2167-1052.1000e138

majored students or scholars [13]. These types of research personnel may play unique roles on this field of anticancer drug combinational evaluation studies.

Future Directions

In future, we must pay more attentions on the breakthroughs of drug combinational rule discoveries and systemized and/or study each possibility of drug combinations in experimental or clinical studies. Only by these discoveries and systemizations, therapeutic efficacies for cancer treatments can be well improved. Since there is no central dogma available for clinical anticancer drug combinations of repeatable experimental protocols and hospital routines, we hope this article can serve as a bridge to embrace better therapeutic options.

Conclusion

Only after completions of all possible assessments of anticancer drug combinations, we can satisfy and enjoy the fruits and improvements of scientific developments and clinical therapeutic outcomes. This is an economic burden yet enormous feedback task. If we can implement it, many beneficial achievements may be expected. Let us kick off this project.

References

1. Siegel RL, Miller KD, Jemal A (2015) Cancer stastistics. CA Cancer J Clin 65: 5-29.
2. Ali I, Rahis-ud-din, Saleem K, Aboul-Enein HY, Rather A (2011) Social aspects of cancer genesis. Cancer Therapy 8: 6-14.
3. Tipping AJ, Melo JV (2003) Imatinib mesylate in combination with other chemotherapeutic drugs: *In vitro* studies. Semin Hematol 40: 83-91.
4. Druker BJ (2003) Imatinib alone and in combination for chronic myeloid leukemia. Semin Hematol 40: 50-58.
5. Strausberg RL, Simpson AJG, Old LJ, Riggins (2004) Oncogenomics and the development of new cancer therapies. Nature 429: 469-474.
6. Siegel DS, Richardson P, Dimopoulos M, Moreau P, Mitsiades C, et al. (2014) Vorinostat in combination with lenalidomide and dexamethasone in patients with relapsed or refractory multiple myeloma. Blood Cancer J 4: e182.
7. Lu DY, Lu TR, Chen XL, Ding J (2012) Individualized cancer chemotherapy. Hypotheses in Clinical Medicine. Nova Science Publisher, US.
8. Lu DY (2014) Personalized cancer chemotherapy, an effective way for enhancing outcomes in clinics. Woodhead Publishing, Elsevier, UK.
9. Lu DY, Lu TR, Che JY, Wu HY (2014) Individualized cancer therapy. IPP 2: 458-469.
10. Lu DY, Chen EH, Ding J, Xu B, Lu TR (2015) Anticancer drug combinations, a big momentum is needed. Metabolomics 5:e139.
11. Millar AW, Lynch KP (2003) Rethinking clinical trials for cytostatic drugs. Nat Rev Cancer 3: 540-545.
12. Ali I, Haque A, Wani WA, Saleem K, Al za'zbi M (2013) Analyses of anticancer drugs by capillary electrophoresis; a review. Biomed Chromatogr 27: 1296-1311.
13. Lu DY, Lu TR (2015) Mathematics or physics-majored students on the biomedical fields, insiders or outsiders? Metabolomics 5: e142.