Cost-effectiveness Considerations of Individualized Cancer Chemotherapy

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Abstract
The running cost for clinical cancer treatment has risen dramatically. It is a huge burden to government fiscal budgets and cancer patients' medical expenditure. Previously, we often create new drug and methodology of high cost and waste human resources for development of many less effects and expensive anticancer drugs or other sophisticated methodologies. These efforts will greatly increase therapeutic costs. Now some countries, such as USA or Japan, are overburden with high expense of medical resources in human diagnosis and therapy, especially for human cancer therapy. One of the major obstacles to controlling cancer growth and metastases is the inappropriate use of anticancer drugs. Treatment using individualized cancer chemotherapy (ICC) has been attracting increasing attention and will continue to show beneficial outcomes in the future. Increasing efforts to develop ICC strategies are generally paralleled with rising fee of diagnostic and prediction of drug responses and expense of anticancer drugs. Systematic evaluation of the relationship between the running costs and benefits of ICC is crucial for updating the ICC systems and making it available in the long run. In this editorial, we address and discuss this matter from different angels.

Keywords: Cancer chemotherapy; Cost-effective; treatment cost; Clinical cancer therapy; Neoplasm metastasis; Personal chemotherapy; Drug combinations

Background
The running cost for clinical cancer treatment has risen dramatically. It is a huge burden to government fiscal budgets and cancer patients' medical expenditure. Previously, we often create new drug and methodology of high cost and waste human resources for development of many less effects and expensive anticancer drugs or other sophisticated methodologies. These efforts will greatly increase therapeutic costs. Now some countries, such as USA or Japan, are overburden with high expense of medical resources in human diagnosis and therapy, especially for human cancer therapy. Thus, we ought to careful check our spending corresponding with the outcome of human cancer treatment and a new name of cost-effective strategy is denominated and was further systematically studied.

One of the major obstacles to controlling cancer growth and metastases is the inappropriate use of anticancer drugs. Treatment using individualized cancer chemotherapy (ICC) has been attracting increasing attention and will continue to show beneficial outcomes in the future. Cost-effectiveness is a long-standing medical problem pervasive in all areas of disease control and is also an early concern about mathematics of cost-effective evaluations of diagnosis and drug responses in ICC. Increasing efforts to develop ICC are generally paralleled with rising fee of diagnostic and prediction of drug responses and expense of anticancer drugs. Systematic evaluation of the relationship between the running costs and benefits of ICC is crucial for updating the ICC systems and making it available in the long run. Since the cost of anticancer and antimetastatic therapy is much longer than overall survival of human cancer therapy, the running cost of cancer chemotherapy will exceed to 10,000 USD, let alone ICC strategies. So the cost-effective study is an important task for saving the money of cancer patients and optimizing a therapy.

Calculation of Cost-Effectiveness
The cost-effectiveness ratio or data is calculated as ratio of costs and quality-adjusted-life-years (QALYs) by Markov analysis. Incremental cost-effectiveness ratio (ICER) < $20,000 is regarded as cost-effectiveness in developed countries [2]. However ICEF might be much lower for cost-effectiveness in developing countries. Apart from cost, the toxicities of a therapy must also be included for selection of a therapy. Some drugs, such as antibodies are very expensive, the calculated ICER is higher than ICER of chemical drugs only. It seems chemical drugs are better than antibodies. However the overall survival of antibodies plus chemical drugs is much longer than overall survival of chemical drugs alone. It is the financial conditions of cancer patients to decide what kind of a therapy a patient may chose [3].

Considering more than $10,000 expenditure of common cycles of drug combination and hospital residence fees, the cancer biomarker or bioinformatics detection fee ($100-5,000) is relatively cost-effectiveness. After detecting cancer biomarkers, it will increase the quality adjusted life year (QALY) of cancer patients, especially in some early stage of cancer [4-7].

For the late stage of cancer patients, it ought to use antimetastatic drugs targeting formed metastatic foci. These types of antimetastatic drug development are currently lacking licensed drugs worldwide. In
Similar data can be seen from reference 12. In routine ICC strategies, evidence of polymorphism of some genes responsible for some varied drug targeting molecules is also a cost-effective problem. These practice, how to genotyping these genes of metabolizing enzymes and beneficial outcomes. This type of problem is a new subject. There might be more suitable to a patient and how much single nucleotide polymorphism (SNP) we ought to detect that can make cost balance. Clinical situation of a patient, and the other consideration is cost. Methodology is the best one to a specific patient? One consideration is the evaluation of the effects of individualized cancer chemotherapy can be different according to different systems. The drug sensitivity testing or genotyping of drug response molecules or metabolizing enzyme genes needs certain amount of money. However their survival benefits are conditional and currently are not steady forward. In other hand, some gene polymorphism is not occurred in some ethnic group—ethnicity frequency equals zero (Table 1), so in these ethnic group, there is no need to genotyping these gene polymorphism before initiating a therapy [12]. So the genotyping of drug response molecules or metabolizing enzyme genes needs differently pharmacogenetics protocols according to patients’ ethnic group and running cost of a patient. Thus economic or ethnic consideration of patients’ real situation is the important things to do. Previous, anticoagulant prophylaxis in operative ovarian cancer patients has been proved to be cost-effective.

### Future Trend

Cost-effective consideration for drug combinations or assistant therapy is one-part work of a clinician and basic cancer chemotherapy studies, especially when some high priced drugs are intended to be used.

In the future, standard automatic software will be perfected and might help us to make satisfactory decision and optimized therapeutic outcomes before individualized cancer chemotherapy begins. The production and perfection of standard software must be innovated and based on much needed data and upgraded with times.

### Conclusion

The ultimate goal of cost effective study of individualized cancer chemotherapy is to maximize therapeutic outcome by minimum cost or funds from cancer patients. The cost of individualized cancer chemotherapy of prediction of drug responses (100-5,000 USD) is relatively less cost than the cost of some expensive anticancer or traditional Chinese medicine assistant therapy seems more acceptable. In late stage, only use of antimetastatic drugs and anticoagulant or traditional Chinese medicine assistant therapy seems more acceptable.

<table>
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<th>Allelic variants</th>
<th>SNP</th>
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<th>Africa</th>
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SNP: single nucleotide polymorphism Ref 12

Table 1: Ethnic frequency (%) of allelic variants in CYP2B6.
antimetastatic drugs or hospital resident fees. Overall, generally individualized cancer chemotherapy is cost-effective, especially for young and early stage of cancer patients. The more appropriately use of funds and predictions of anticancer drug responses, the more therapeutic benefits a patient might achieve for a specific cancer patient.

References


