Abstract

In vitro chemosensitivity and resistance assay determine the sensitivity of a specific tumor after a specific treatment administration in an experimental setup. A heterogeneous population of cancer cells is exposed to various approved anticancer drugs in short-term *ex vivo* and their combination thereof. The effect of each drug is then determined based on the viability of specific tumor cells allowing for individual patient treatment using a precise combination of drugs. This approach is an example of the personalized medicine principle, which is focusing on the adjustment of diagnostic procedures and treatment of a specific patient. Therefore, its goal is to avoid treatment failure in patients with poor response to the statistically most effective treatments based on randomized clinical trials.

The number of viable cells determined by the flow cytometry provides very accurate statistics for multiparametric analysis. A necessary prerequisite is the presence of dissociated cancer cells in a single cell suspension. This is different from cloning methods, where tumor colonies grow on agar media, or from histocultures, which are specific with its three-dimensional tissue cultivation. We can also sort cells from suspension based on their pre-defined attributes for their subsequent functional testing.

The advantage of CSRA assays is the speed and relatively low cost, which allows us to adjust the treatment according to the result in a very short period of time after tumor excision. The use of flow cytometry is beneficial in cases where problems arise due to CSRA reset variability caused by high tumor mutability and heterogeneity not only in the large cohort but also within a given patient where cancer microevolution occurs in the course of the disease. A heterogeneity of individual tumors is being constantly changed throughout the course of treatment.

Conducted studies prove that the cancer resistance detection against a specific anticancer drug can achieve 100% accuracy. Cancer sensitivity can be determined with rather lower accuracy at 80% maximum. According to oncological associations, CSRA tests are still not implemented in routine clinical practice, due to lack of supportive evidence in the metaanalysis of published data. However, this literature does not include flow cytometric studies. Despite the conclusions of oncological associations, many US- and EU- based oncologists do not fully agree.

Key words

in vitro assay, chemosensitivity, tumor resistance, CSRA, flow cytometry, tumor, tumor heterogeneity, microevolution, *ex vivo* testing, personalized medicine, clinical trial