News and Perspectives

Further Promise and Potential for Precision Medicine in Oncology

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Key Takeaways

- Cancer drug treatments can be safely and effectively personalized based on the distinct and complex molecular profiles of a patient's tumor.
- A new precision oncology approach using cotargeted and individualized multidrug therapy can enhance treatment success including higher disease control rate, longer progression-free survival, and longer overall survival with fewer side effects.
- Patients whose drug therapies more closely matched their tumor mutations showed higher treatment response rates and better survival outcomes.

Cancer and cancer treatments are not one-size-fits-all, even for the same type of cancer. Cancer patients differ by age, sex, frailty, organ function, and metabolic characteristics, which can profoundly influence treatment effectiveness and side effects. As a result, standard dosing strategies can leave some patients receiving too little drug, leading to reduced anticancer activity, while others get excess drug, leading to toxicities that compromise quality of life or prompt treatment discontinuation.

Beyond patient differences, tumors themselves are heterogeneous. Next-generation sequencing (NGS) confirms that advanced cancers often have complex molecular profiles with multiple genomic alterations that are distinct from patient to patient [1]. Where traditional precision oncology work has typically focused on targeting single mutations with single drugs [2,3], growing evidence suggests this may oversimplify tumor biology and that more nuanced approaches are necessary [4,5].

"Every patient's tumor is a little bit different because we all are a little bit different. Even twins are not exactly the same. But yet, the way we think about treating patients is, one size fits all approach or factoring in one mutation and its tumor or one molecular alteration and its tumor and then targeting it," says Jason Sicklick, MD, professor of surgery and pharmacology at UC San Diego School of Medicine and surgical oncologist at UC San Diego Health.

Sicklick is the senior author of a recent study [6] exploring treatment strategies that account for this molecular complexity by targeting multiple genomic alterations simultaneously and tailoring to each patient in an "N of 1" approach. "We individually focused on each patient, how they're unique, the unique biology of their tumor in order to figure out how to come up with the best therapy," he says.

Novel Single-Drug and Multidrug Therapies

Conducted as part of the Investigation of Profile-Related Evidence Determining Individualized Cancer Therapy (I-PREDICT) trial, Sicklick and colleagues' latest clinical study builds on earlier work [7,8] by including more patients and longer follow-up, while offering detailed guidance on how to replicate precision cancer care strategies.

The trial used advanced genomic sequencing to identify the genetic changes driving each person's cancer and create unique tumor profiles. These were then used by clinicians of the UCSD Moores Cancer Center [9] to develop individualized treatment plans, generating a matching score quantifying the fraction of alterations targeted by treatment relative to all genetic alterations present in each patient's tumor. In the trial, 210 patients, of whom the majority (58%) were women with aggressive, advanced colorectal, pancreatic, ovarian cancers or sarcomas, got one or more US Food and Drug Administration–approved drugs (mostly off-label) comprising 157 different regimens, including 103 personalized combinations without established safety/dosing data.

New drug combinations were started at lower doses and carefully increased over time to keep the treatments safe. Both starting doses and dose adjustments through the treatment period were individualized based on the number and types of drugs and based on each patient's condition and tolerance. In approximately 36% of patients, most dose changes in the first 6 months were dose reductions, with only around 8% of patients having dose increases and approximately 57% having no dose changes.

Better Matching, Better Results

Approximately 95% of patients had unique molecular landscapes—meaning, nearly every patient's tumor had a distinct combination of genetic alterations. Those whose drug therapies most closely matched their specific tumor

mutations experienced better treatment results, including better treatment responses and survival outcomes.

A higher degree of matching between drugs and tumors' molecular alterations significantly correlated with both longer progression-free survival and longer overall survival. Age, sex, tumor type (gastrointestinal vs non-gastrointestinal), immunotherapy administration, mean initial dose percentage, number of previous therapies, and number of drugs given to a patient did not correlate significantly or independently with either outcome.

Patients who received new drug combinations did not experience any more severe side effects than those who got standard therapies like chemotherapy, radiation, or standardized (nonpersonalized) medications. In fact, only 6.5% of these patients experienced severe or life-threatening drug-related toxicities compared to 15.5% of those receiving established regimens.

"Patients, even if they come in with the same cancer, like pancreatic cancer or breast cancer, have a different gene pattern needing a unique cocktail [of] medication. We're targeting the cancer gene based on the unique gene pattern. Not having the standard approach," says Shumei Kato, MD, associate professor of medicine at UC San Diego School of Medicine and medical oncologist at UC San Diego Health. "Compared to chemo, the more precise targeted therapy is a lot easier on a patient's body," says Kato.

"In 10 years," he hopes, "personalized medicine for cancer will be one of the standard approaches. We still need to have chemo, depending on the case, but I'm hoping personalized medicine will be one additional option for every patient."

Next Steps

This nonrandomized study lays the groundwork for a future trial designed to confirm the benefits of this personalized precision oncology approach.

"Further validation is definitely needed. We will need more numbers for patients to be treated. I think this is still in its infancy. With all the data accumulated, we are hoping to understand which pattern of cocktail is better compared to the other cocktail. I think the more information we have, we have a better idea," says Kato.

"For the next trial, we're developing a randomized approach to further test the hypothesis and provide evidence that this personalized approach can be utilized in an effective manner to improve outcomes in patients as compared to standard care approaches in patients with complex tumors with multiple molecular alterations," says Sicklick.

"With evolution of different technologies and approaches, we're getting more drugs out there that can target more of the different pathways and tumors, and it's really providing us with a larger repertoire of things in our armamentarium that can allow us to treat patients. We have more widely available molecular testing now. We've got a lot more drugs now. We've got even better molecular testing that's faster and more data being provided to us," he says.

Alongside other advances in genomic sequencing, molecular profiling, and predictive analytics [10-13], future studies may help establish this approach as a new standard in precision oncology.

Updated April 8, 2026: An earlier version of this article contained a typo in one of the quotes: "...have a different gene patterns…" This has been corrected in the current version.

Keywords: precision medicine; molecular profiling; biomarkers; tumor; antineoplastic agents; drug therapy; combination; high-throughput nucleotide sequencing; genetic testing; neoplasms

Conflicts of Interest

None declared.

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