Measuring treatment response proves to be a powerful tool for guiding leukemia treatment

March 20 2015

Measuring the concentration of leukemia cells in patient bone marrow during the first 46 days of chemotherapy should help boost survival of young leukemia patients by better matching patients with the right intensity of chemotherapy. St. Jude Children's Research Hospital investigators led the research, which appears in the March 20 edition of the journal *Lancet Oncology*.

The findings stem from a study of 498 children and adolescents with acute lymphoblastic leukemia (ALL) enrolled in a St. Jude-led protocol between 2000 and 2007. The clinical trial was the first to use measurement of residual leukemia cells – or minimal residual disease (MRD) – in bone marrow to help guide therapy. St. Jude pioneered MRD measurement as a tool to guide leukemia treatment.

"This analysis shows that MRD-directed therapy clearly contributed to the unprecedented high rates of long-term survival that patients in this study achieved," said first and corresponding author Ching-Hon Pui, M.D., chair of the St.Jude Department of Oncology. Overall, 93.5 percent of patients were alive five years after their cancer was diagnosed. "MRD proved to be a powerful way to identify high-risk patients who needed more intensive therapy and helped us avoid over-treatment of low-risk patients by reducing their exposure to chemotherapy," Pui said.

Researchers hope the findings will expand use of MRD measurements to guide leukemia treatment in children and adults.

The technique might also help identify patients who could be cured with less intensive chemotherapy, Pui said. Overall long-term survival was 97.9 percent or better for 244 patients in this study classified as low risk based on a variety of factors including their age at diagnosis and MRD of less than 1 percent on day 19 of treatment. "Given the excellent outcome, it will be important to determine if treatment can be further reduced in this subgroup of patients," Pui said.

In countries with limited resources, Pui said the findings suggest that results of MRD on day 19 can be used to reduce treatment-related deaths by identifying patients who will likely be cured with low-intensity chemotherapy. "This study demonstrates these patients have an extremely low risk of relapse," he said.

The study showed that measuring MRD just twice during remission induction therapy – at day 19 and day 46 – rather than multiple times during the more than two years of treatment was sufficient to guide treatment of most pediatric ALL patients. That will help save money and protect patients from the discomfort and risks associated with bone marrow aspiration for MRD testing. MRD measurements should continue, however, to guide treatment of patients with detectable MRD on day 46 of treatment. That is a level of 0.01 percent or more, which translates into one leukemia cell in 10,000 normal cells.

MRD was not a perfect predictor of relapse risk. Cancer returned in 26 of the 430 patients with undetectable MRD when treatment ended after 120 weeks. Researchers are working to develop even more sensitive methods for tracking treatment response in order to identify those at risk for having their cancer return.

Overall, researchers showed that regardless of other risk factors, including age at diagnosis or the initial white blood cell count, patients with an MRD level of 1 percent or more on day 19 of therapy were far

less likely than other young leukemia patients to be alive and cancer-free 10 years later. Having detectable leukemia cells on day 46 of treatment was also associated with lower survival.

MRD levels on days 19 and 46 led to the reclassification of 50 patients from low risk to a higher risk leukemia that warranted more intensive therapy. Researchers credited the change with boosting survival.

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Provided by St. Jude Children's Research Hospital