**Increasing survival rate of leukemia patients by novel minimal residual disease detection method**

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**Leukemia is a hematopoietic cancer that is the most common cancer among children and has proven to be difficult to treat [4]. Even after achieving complete remission via chemotherapy and radiation treatments, the disease still has a relatively high relapse rate of about 20% in children and up to 50% in adults [3]. Because of the high relapse rate and commonality amongst children, improving the methods of relapse detection to increase the overall survival rate has been a leading focus in the oncology research field. The most common method for detecting leukemia cells in patients who had already achieved remission has historically been performing polymerase chain reaction (PCR) amplification of certain transcripts from bone marrow samples [4]. In the last five years, researchers have discovered a novel technique of using multicolor flow cytometry (MFC) to detect for minimal residual disease (MRD) in leukemia patients who had already achieved complete remission. This method of MFC has proven to be more efficient than PCR [4,5]. MRD detection in patients is directly correlated with leukemia relapse, so early detection of MRD is crucial for increasing the survival rates of patients [1].**

**Introduction**

Detecting minimal residual disease as early as possible is linked to higher survival rates in leukemia patients as it has been proven to be a highly sensitive prognostic parameter of the cancer [1,5]. Minimal residual disease (MRD) is defined as when a leukemia patient who is in complete remission and has no clinical symptoms of disease is found to have molecular evidence of precursor molecules or specific biomarkers of cancerous leukemia cells detected in samples [1,2]. For decades, by using PCR, MRD was not fully understood or even detectable when the MRD was in early stages. In many cases, PCR tests weren’t performed until after symptoms of relapse had occurred in patients. Although this method of detection works well, the cancer was in a more advance state when detected, so it was often too late for additional treatment and the patient would ultimately succumb to the cancer [3]. Because MRD is associated with relapse, it is common for patients to undergo STEM cell transplants, formerly referred to as bone marrow transplants (BMT), to completely eradicate the mutated hematopoietic cells in their own bone marrow and replace it with new and healthy ones. This means that the novel MFC is beneficial to increasing survival rates as it can be a crucial factor in determining how soon a patient needs to undergo the transplant; ultimately curing their leukemia.

**Recent Progress**

There are four main types of leukemia, two of which are considered chronic and the other two being acute. Regardless of what type of leukemia a patient has, the overwhelming problem for leukemia patients after their treatment is the high chance of relapse. Almost 90% of patients with leukemia will achieve remission after only a month of chemotherapy, but the relapse rate in the five-year span following treatment is almost 50% in adults [3]. PCR tests and bone marrow biopsies have been the leading method for relapse detection in patients. The problem with this is that by the time it is detectable by PCR or in a biopsy, the leukemia is in a more advanced state and is also more resilient to further chemotherapy treatments, leading to a poor prognosis [2,5]. The challenge of finding earlier detection has recently been finding much progress. Researchers across the world have been utilizing the newly discovered and highly effective method of MFC to locate specific biomarkers within tissue samples from patients to detect leukemia relapse well before its PCR counter method can [4,5]. A specific study had found that the CD79a biomarker worked exceptionally well in detecting MRD. Using MFC they were able to detect the biomarker at a 1:10,000,000 scale with 88% specificity and 100% sensitivity [5].

**Discussion**

Being that MRD detection is a powerful prognostic tool for leukemia relapse, optimizing its detection and improving early-detection skills have paved the way for MFC innovation in the last five years. MFC wasn’t utilized for MRD detection until 2017 [6], so the practice is still novel, and variations of the method are being made and improved upon constantly. The specific biomarkers and tissue sample locations are two important variables in the field. A revolutionary study was performed just this year that involved taking cryopreserved ovarian cortex samples from 15 leukemia patients and subjecting them to MFC and PCR that resulted in the MFC to be for efficient in detecting specific molecular markers [4]. This suggests that new and innovative ways are being explored every day in order to improve the outcomes of patients. There needs to be more clinical studies done to expand the biomarker field for the practice. MFC use has surpassed the use of PCR for biomarker detection in recent years not only because of its specificity and early-detection benefits, but also because it is easy to use, has a large number of parameters that are simultaneously available and has a high throughput analysis [4]. These factors combined with the new experimentation are reason for MFC research to be used in different areas of oncology.

**References**

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