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The Role of MRD Assessment in Personalized Treatment Strategies for Leukemia and Lymphoma

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Introduction

Minimal Residual Disease (MRD) assessment has emerged as a pivotal tool in the management of leukaemia and lymphoma, transforming the treatment landscape for these hematologic malignancies. Traditionally, treatment decisions were based on clinical and pathological features. However, MRD assessment provides a deeper insight into the disease burden, allowing for personalized treatment strategies that optimize outcomes and minimize side effects. This article explores the evolving role of MRD assessment in tailoring therapy for leukaemia and lymphoma, highlighting its clinical significance and impact on patient care [1].

MRD refers to the small number of cancer cells that may persist in a patient's body following treatment, even when no clinical or pathological evidence of disease is present. These residual cells are often responsible for disease relapse and can be detected at molecular, cytogenetic, or immunophenotypic levels using various techniques such as polymerase chain reaction (PCR), flow cytometer and next-generation sequencing (NGS). MRD assessment provides valuable prognostic information. Patients who achieve MRD negativity after treatment tend to have better long-term outcomes, including higher rates of disease-free survival and overall survival. Conversely, the persistence of MRD is associated with an increased risk of relapse. MRD assessment allows clinicians to monitor a patient's response to therapy during and after treatment. It provides an early indication of treatment efficacy and enables adjustments to treatment plans if necessary. MRD status helps in stratifying patients into risk categories. High-risk patients with persistent MRD may benefit from more intensive therapy or novel treatment approaches, while low-risk patients with MRD negativity may be spared from unnecessary treatments and their associated toxicities [2].

For patients with detectable MRD following initial therapy, intensification of treatment, such as stem cell transplantation or targeted therapies, may be considered to eliminate residual disease and prevent relapse. MRD negativity allows for the de-escalation of therapy in some cases. This personalized approach reduces the risk of treatment-related complications, such as infections and organ damage, while maintaining high efficacy. Immunotherapeutic agents, such as monoclonal antibodies and CAR-T cell therapy, are increasingly used in conjunction with MRD assessment. These therapies can specifically target and eliminate MRD, offering promising results in certain cases. MRD assessment helps determine the optimal duration of treatment. Patients who achieve MRD negativity may have the option to discontinue treatment earlier, reducing the overall treatment burden [3, 4].

Different laboratories may use varying techniques for MRD assessment, leading to variability in results. Standardization efforts are on-going to ensure consistency and comparability of MRD data. Achieving high sensitivity in MRD detection is critical, as even a small number of residual cells can lead to relapse. On-going research aims to improve the sensitivity of MRD assays. Some MRD assessment methods, especially advanced NGS techniques, can be costly and may not be readily available in all healthcare settings. Access to these tests needs to be expanded. Interpreting MRD results requires expertise, as the significance of a specific MRD level may vary depending on the disease type and treatment context [5].

Conclusion

The role of MRD assessment in personalized treatment strategies for leukaemia and lymphoma is transformative. It enables clinicians to tailor treatment plans based on an individual's disease burden and response to therapy, leading to improved outcomes and a better quality of life for patients. As technology advances and our understanding of MRD deepens,

the integration of MRD assessment into routine clinical practice is likely to expand, offering new hope for patients battling these challenging hematologic malignancies. However, addressing challenges related to standardization, cost and accessibility will be crucial in harnessing the full potential of MRD assessment in leukaemia and lymphoma management.

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