PREFACE

Leukemia is a heterogeneous group of hematological malignancies characterized by the proliferation of abnormal lymphoid or hematopoietic cells in the bone marrow, frequently involving peripheral blood, spleen, and lymph nodes. Leukemia is the 10th most common human malignancy, with over 60,000 new cases diagnosed in the United States every year and approximately 1.5% of people diagnosed at some point during their lifetime. Tremendous advances have been made in the biology and genetics of leukemia during the past several decades, which have translated into significantly improved clinical management and survival outcome. This 10-chapter book provides the most up-to-date information on important topics such as prognostic and predictive biomarkers, new World Health Organization (WHO) classification, pharmacogenomics, and measurable (minimal) residual disease (MRD). Also included in this book are in-depth reviews of several interesting leukemia entities, which update these entities from various aspects including etiology, pathogenesis, histopathology, diagnosis, treatments, and clinical outcomes.

The WHO classification of tumors has provided a unified tumor classification system enabling people across the world to share their experience, knowledge, and research results. Ongoing research work conducted by many researchers and physicians has been leading to our continuously improved understanding of tumors and the continual production of new editions of WHO classification with updates. It is no surprise that the newly released 5th edition of WHO classification of hematolymphoid tumors has numerous revisions, which are succinctly summarized in Chapter 1. All the leukemia entities have been updated or revised with a variable degree of changes, including the addition of new subtypes, deletion of subtypes, terminology or nomenclature revision, name changes, revised diagnostic criteria, revised categorization, etc. No matter whether you need to study or you are interested in studying this 5th edition of WHO classification, you will find that Chapter 1 is very helpful.

Chapters 2 and 3 provide comprehensive overviews of two unique leukemia entities: infant leukemia and hairy cell leukemia. Both entities have distinct genetic alterations, which are detailed in these two chapters. Chapter 3 also gives extensive updates on the current treatments for newly diagnosed and relapsed/refractory hairy cell leukemia. One of the biggest improvements in our journey of understanding and treating leukemia is the application of flow cytometry immunophenotyping in the diagnosis and classification. Chapter 4 provides an overview of the principles and the significant roles of flow cytometry in the diagnosis and classification of leukemias. Flow cytometry is also a useful tool for detecting MRD, which is the strongest independent prognostic factor for leukemia. Patients with undetectable MRD or good MRD responses have significantly lower relapse risk and better survival outcomes compared with similarly treated patients with detectable MRD or adverse MRD responses. MRD testing has become increasingly important in risk stratification and guiding individualized therapy for patients with leukemias, especially acute leukemia. Quantitative PCR is another commonly used method for MRD testing. Recently, innovative technologies such as

next-generation sequencing and digital PCR have also been applied in the clinical studies of MRD assessment and have shown improved sensitivity and accuracy. Chapter 5 gives a comprehensive overview of the methods and the clinical significance of MRD testing in acute lymphoblastic leukemia (ALL) and acute myeloid leukemia (AML).

Chapters 6 and 7 are dedicated to two types of AML with poor prognosis: AML with myelodysplasia-related changes (AML-MRC) and secondary AML. Chapter 6 gives full coverage of AML-MRC, including epidemiology, pathology, genetic alterations, diagnosis, clinical features, treatments, and prognosis, while Chapter 7 focuses on the pathogenesis and treatments of secondary AML. Chapter 8 covers a rare disease of myeloid/lymphoid neoplasms with platelet-derived growth factor receptor alpha (PDGFRA) rearrangement, with emphasis on the diagnosis and the differential diagnosis.

ALL is the most common childhood cancer. Thanks to the risk stratification and subsequent risk-adapted treatment, ALL has become the most curable malignancy in children, with long-term survival rate close to 90%. Chapters 9 and 10 tell the key elements contributing to the success of risk stratification and risk-adapted therapies in ALL. Chapter 10 provides an up-to-date comprehensive overview of the prognostic and predictive biomarkers in B-ALL, which include over 20 genetic biomarkers, some immunophenotypic biomarkers, and other biomarkers that predict prognosis or therapeutic response. Recent advances in molecular diagnostic technologies have led to a rapid expansion of the list of molecular biomarkers associated with ALL. Most of these recently identified biomarkers are included in Chapter 10. These new genetic biomarkers show promise to improve the accuracy of risk prediction, and eventually achieve better risk-adapted treatment and clinical outcomes. Chapter 9 focuses on the genetic variations that are associated with toxicity and/or resistance to most of the chemotherapy drugs used for ALL, which are also important factors to guide personalized treatment.

I thank all the authors for their outstanding contributions and the time they have devoted to this book. Most of the chapters in this book are aimed primarily at physicians, researchers, and other healthcare professionals, but some areas may also capture the interest of the laypersons. Studies of leukemia have always been at the forefront in applying the findings of basic research to the understanding and treatments of human diseases and have many exciting achievements. I hope this book will encourage readers to dive into this field, embracing the achievements cheerfully and viewing the challenges optimistically.

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