Preface

Progress and Promise of Biomarker Discovery and Development in Urologic Disease

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Editor

Over the past several years, there has been an enormous amount of research in biomarkers in both benign and malignant urologic conditions. Scientific advances using a multitude of various -omics pathways, including genomics, transcriptomics, proteomics, metabolomics, radiomics, microbiomics, and other methods using olfaction-based research have afforded investigators with multiple new tools to interrogate blood, urine, seminal fluid, and tissue for promising novel biomarkers. Furthermore, the efficiency and cost associated with these analyses have dramatically improved, resulting in an ability to perform larger-scale investigations in a high-throughput manner. Other novel methodologies, including statistical improvements using artificial intelligence, have similarly created new opportunities for the development of clinically meaningful and accurate biomarkers.

Despite an enormous amount of research effort and expenditure, many potential biomarkers have failed to successfully make the leap from bench to bedside, and for those which have become commercially available, understanding their value, cost effectiveness, and how to use them can be challenging for the clinical urologist. This issue of *Urologic Clinics* is dedicated to the practicing urologist to understand what has been the latest research in biomarkers in urology, but also and perhaps more importantly, which biomarkers can be clinically useful at this time.

Our initial article in this issue introduces the various scientific approaches to biomarker discovery and addresses some of the methodologic challenges, using biomarker investigation in pediatric urology as an example. Although the majority of biomarker research in urology has been focused on the genitourinary cancers, there has been significant interest in biomarker development to assist in the management of benign urologic conditions. Biomarkers to determine nephrolithiasis risk, development, and recurrence has become a major area of investigation with significant clinical implications. An understanding of the biologic basis of the pathophysiology of urethral stricture disease can allow us to utilize biologic indicators for improved management of our patients. Similarly, research into the biologic underpinnings of interstitial cystitis may allow us to better characterize and personalize the management of this disease.

Urologic oncology has seen an explosion in biomarker research. Many have investigated biomarkers in both non-muscle-invasive bladder cancer and muscle-invasive disease, improving our understanding of the biology of cancer and attempting to better detect new and recurrent disease, as well as improve patient selection for various treatments options.

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While prostate-specific antigen (PSA) is one of the best known and investigated biomarkers in all of medicine, an enormous amount of time and money have been spent in an effort to surpass PSA and improve our detection and management of prostate cancer. A PubMed search of "biomarkers AND prostate cancer" results in 43,798 hits for articles, indicating the vast volume and breadth of research in this field. In addition to the classic approach to measurable biomarkers in body fluids and tissues, the use of imaging as a biomarker has exploded in prostate cancer in the form of multiparametric MRI and even more recently targeted molecular imaging using prostate cancer–specific biomarkers.

Testicular cancer, penile cancer, and kidney cancer have had less of a revolution in biomarker discovery than the other urologic malignancies. However, significant improvements in the biologic understanding of these disease processes have led to improvements in biomarker assessment, which, similar to other disease states, have resulted in advances in patient care.

Although it is impossible to cover every aspect and all novel research on biomarkers in all areas of urology, we hope that this issue of *Urologic Clinics* will shed some light on the progress and promise of biomarkers in our field and how we might use them now and in the future to improve the care and management of our patients.

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