Endocrine Disorders in Kidney Disease

Diagnosis and Treatment

Connie M. Rhee
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Preface

This inaugural edition of *Endocrine Disorders in Kidney Disease: Diagnosis and Treatment* is dedicated to examining the complex interplay between endocrine and kidney disorders and how this interrelationship impacts patients with chronic kidney disease, including those receiving renal replacement therapy in the form of dialysis and kidney transplantation. Indeed, chronic kidney disease patients are a unique population among whom a myriad of hormonal derangements may exist. While there has been growing appreciation of this important link between endocrinology and nephrology, many endocrine disorders may remain latent and under-recognized among kidney disease patients.

Hence, this scholarly work is the product of a collaborative effort among experts in areas of endocrinology and nephrology in order to provide a comprehensive overview of the most relevant endocrine disorders observed in the chronic kidney disease population. Part 1 entitled *Diabetes, Insulin, Resistance, and the Metabolic Syndrome* presents a practical overview of areas commonly encountered in the clinical management of diabetic kidney disease patients, as well as kidney transplant recipients who develop new onset diabetes. Part 2 entitled *Thyroid Dysfunction* presents innovative themes pertaining to the high prevalence of thyroid dysfunction in kidney disease, including real-world interpretation of thyroid functional derangements and emerging data on thyroid dysfunction and outcomes in the chronic kidney disease population. Part 3 presents highly pertinent information on *Gonadal Disorders*, which include testosterone deficiency and other testicular conditions, as well as amenorrhea and estrogen disorders in the chronic kidney disease population. Also included in this section is a chapter on pregnancy in kidney disease describing maternal, fetal, and obstetric outcomes, as well as general principles of management. Part 4 entitled *Dyslipidemia* provides valuable insights into the vast spectrum of lipid disorders associated with chronic kidney disease and nephrotic syndrome, as well as a rigorous summary of existing evidence and clinical practice guidelines addressing the management of dyslipidemia in kidney disease. Part 5 provides an extensive overview of the full-spectrum of *Mineral Bone Disorders* encountered in kidney disease, including calcium, phosphate, fibroblast growth factor 23, vitamin D, and parathyroid hormone alterations; osteoporosis and osteomalacia; and mineral bone derangements observed in kidney transplantation. Emerging data on *Obesity and Adipokines* in kidney disease are presented in Part 6. Then in Part 7 entitled *Other Pituitary Disorders*, experts in the field describe

pituitary disorders in kidney disease including growth hormone disorders and abnormal stature, as well as prolactin, glucocorticoid, and arginine vasopressin derangements. Finally, Part 8 synthesizes many of the aforementioned themes by describing the Multi-System *Implications of Endocrine Derangements in Kidney Disease*, including endocrine derangements in acute kidney injury, as well as the interaction between nutrition and endocrine disorders in kidney disease.

We hope that the insights provided by this scholarly endeavor will engender greater understanding of the magnitude of impact that endocrine disorders have upon the kidney disease population, as well as identification of persistent gaps in knowledge that point toward future areas of investigation, with the overarching goal of improving the health and survival of chronic kidney disease patients. We thank all of our authors for their extraordinary expertise and valuable contributions, as well as the Springer editorial team for their tremendous support, which made the development of this unique textbook and resource possible.

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Part VII Other Pituitary Disorders

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Part I

Diabetes, Insulin Resistance, and the Metabolic Syndrome

1 Insulin Resistance and the Metabolic Syndrome in Kidney Disease (e.g., the Cardiorenal Metabolic Syndrome)

Vikram Patney, Sivakumar Ardhanari, and Adam Whaley-Connell

Introduction

The metabolic syndrome is a collection of abnormalities that are risk factors for the development of cardiovascular and chronic kidney disease (CKD). While current dogma suggest that obesity is at the core of this constellation of risk factors, the association between blood pressure and diabetes was described as early as 1921 [1–4]. Then during the 1988 Banting lecture, G.M. Reaven suggested that the clustering of risk factors in an individual including high blood pressure, impaired glucose tolerance, and dyslipidemia was associated with coronary artery disease. At that time he grouped these metabolic disorders and referred to them as "syndrome X." He proposed that resistance to insulin-stimulated glucose uptake and compensatory hyperinsulinemia contributed to the development of non-insulin-dependent diabetes mellitus, hypertension, and coronary artery disease [5]. This interest in "syndrome X" became an area of investigative interest for many in the 1990s and early 2000s that ultimately led to a better understanding of the relationship between obesity, insulin resistance, and cardiovascular and kidney disease.

In modern terms, the "metabolic syndrome" refers to a set of physical and laboratory parameters whose co-occurrence in an individual may help clinicians identify the presence of insulin resistance as a chance to intervene early in the course of cardiovascular disease [6, 7]. In addition to syndrome X, other terms that have been used to describe a similar group of risk factors are "insulin resistance syndrome," "dysmetabolic syndrome X," and also "Reaven's syndrome." Since then, a number of organizations have sought to name and define this syndrome including the National Cholesterol Education Program Adult Treatment Panel III (ATP III), World

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