

Endocrine and metabolic emergencies: hypocalcaemia

Richard Carroll and Glenn Matfin

Abstract: Hypocalcaemia is a common electrolyte disturbance, especially in the inpatient setting. There are a wide variety of causes of hypocalcaemia and correct management depends on the underlying diagnosis. However, acute hypocalcaemia is associated with significant morbidity and mortality and should be managed as a medical emergency. Chronic care of the hypocalcaemic patient is also briefly described, as this is an important opportunity to reduce further admissions related to both hypocalcaemic and hypercalcaemic presentations.

Keywords: hypocalcaemia, parathyroid hormone, vitamin D

Introduction

Hypocalcaemia is a common electrolyte disturbance complicating approximately 26% of hospital admissions, and is found in as many as 88% of patients admitted to an intensive care unit (ICU) [Zivin *et al.* 2001]. There are a large number of recognized causes (see Table 1) and correct management depends on appropriate diagnosis [Matfin, 2009; Murphy and Williams, 2009]. Chronic hypocalcaemia may be asymptomatic even at low levels of serum calcium, but severe or acute hypocalcaemia is associated with predictable signs. Hypocalcaemia with neurological, muscular or cardiac dysfunction is associated with significant morbidity and mortality and should be managed as a medical emergency [Hästback and Pettilä, 2003].

Pathophysiology

Calcium, phosphate and magnesium are the major divalent cations in the body [Matfin, 2009; Murphy and Williams, 2009; Selby, 2002]. They are ingested in the diet, absorbed from the intestine, filtered in the glomerulus of the kidney, reabsorbed in the renal tubules and eliminated in the urine. Only a small amount of these three ions is present in extracellular fluid (ECF). This small, but vital, amount of ECF calcium, phosphate and magnesium is directly or indirectly regulated by vitamin D and parathyroid hormone (PTH) [Matfin, 2009; Murphy and Williams, 2009; Selby, 2002].

Although classified as a vitamin, vitamin D functions as a hormone [Pearce and Cheetham, 2010; Matfin, 2009; Murphy and Williams, 2009; Whyte and Thakker, 2009; Selby, 2002]. It acts to sustain normal plasma levels of calcium and phosphate by increasing their absorption from the intestine, and is also necessary for normal bone formation. Vitamin D₃ is synthesized by ultraviolet irradiation of 7-dehydrocholesterol, which is present in the skin or obtained from foods in the diet, many of which are fortified with vitamin D. Once vitamin D enters the circulation from the skin or intestine, it is concentrated in the liver. There it is hydroxylated to form 25-hydroxyvitamin D₃ (25-(OH)D₃). It is then transported to the kidney, where it is transformed into active 1,25-dihydroxyvitamin D₃ (1,25-(OH)₂D₃). The major action of the activated form of vitamin D, also called *calcitriol*, is to increase the absorption of calcium from the intestine. Calcitriol also sensitizes bone to the resorptive actions of PTH. There is also recent evidence that vitamin D controls parathyroid gland growth and suppresses the synthesis and secretion of PTH. The formation of 1,25-(OH)₂D₃ in the kidneys is regulated in feedback fashion by plasma calcium and phosphate levels.

PTH, a major regulator of plasma calcium and phosphate, is secreted by the parathyroid glands. There are four parathyroid glands located on the dorsal surface of the thyroid gland. The dominant regulator of PTH is the plasma calcium

Ther Adv Endocrinol Metab

020108 1110 29–33

DOI: 10.1177/

2042018810366474

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Cumulated Index Medicus ,1988 **Medical and Health Care Books and Serials in Print** ,1986 **Whitaker's Book List** ,1991 *Metabolic and Endocrine Emergencies* Habeeb Bacchus,1984-01-01 Subject Guide to Books in Print ,1984 **Endocrine and Metabolic Emergencies** ,1980 **Metabolic Syndrome Consequent to Endocrine Disorders** V. Popovic,M. Korbonits,2018-04-05

Hormonal dysfunction can have a major and often complex impact on all key components of the metabolic syndrome This book comprises state of the art reviews on the subject written by recognized experts in the field of endocrinology Each chapter covers specific manifestations associated with the metabolic syndrome in classic endocrine diseases Compelling questions are highlighted and future directions presented The topics covered include hypopituitarism adrenal insufficiency acromegaly glucocorticoid excess androgen excess hypogonadism prolactin and thyroid and parathyroid hormone abnormalities This book is meant to inspire subsequent research related to metabolic complications in endocrine diseases thus enabling early detection as well as prompt and appropriate management Endocrine Disrupting Chemicals-induced Metabolic Disorders and Treatment Strategies Muhammad Sajid Hamid Akash,Kanwal Rehman,Muhammad Zaffar Hashmi,2020-08-04 This volume offers a detailed and comprehensive analysis of Endocrine Disrupting Chemicals EDCs covering their occurrence exposure to humans and the mechanisms that lead to the pathogenesis of EDCs induced metabolic disorders The book is divided into three parts Part I describes the physiology of the human endocrine system with special emphasis on various types of metabolic disorders along with risk factors that are responsible for the development of these disorders Part II addresses all aspects of EDCs including their role in the induction of various risk factors that are responsible for the development of metabolic disorders Part III covers up to date environmental regulatory considerations and treatment strategies that have been adopted to cure and prevent EDCs induced metabolic disorders This section will primarily appeal to clinicians investigating the causes and treatment of metabolic disorders The text will also be of interest to students and researchers in the fields of Environmental Pharmacology and Toxicology Environmental Pollution Pharmaceutical Biochemistry Biotechnology and Drug Metabolism Pharmacokinetics

Metabolic Syndrome Rexford S. Ahima,2024-03-06 This comprehensive reference work presents an up to date survey of the current scientific understanding of the metabolic syndrome as well as an overview of the most significant advances in the field The book offers a thorough reference for obesity and the metabolic syndrome and will prove an indispensable resource for clinicians researchers and students The obesity epidemic has generated immense interest in recent years due to the wide ranging and significant adverse health and economic consequences that surround the problem Much attention has been focused on excessive consumption of energy dense food sedentary lifestyle and other behaviors that contribute to the pathogenesis of obesity However obesity is a highly complex condition that is influenced by genetic as well as environmental factors The metabolic syndrome comprises of central obesity hyperglycemia hypertension and dyslipidemia The incidence of

metabolic syndrome is growing worldwide affecting more than one third of adults in some countries The metabolic syndrome increases the risk of developing coronary artery disease and stroke and it is closely associated with fatty liver dementia cancer sleep apnea kidney failure and other diseases This reference work covers the full range of scientific and clinical aspects of obesity and metabolic syndrome epidemiology genetics environmental factors pathophysiology diseases associated with obesity pediatric obesity and clinical management

Overweight and the Metabolic Syndrome: George A. Bray, Louisiana State University, Donna Ryan, 2007-02-16 Overweight and the Metabolic Syndrome will provide an overview of topics related to obesity including associated health risks childhood obesity genetics evaluation treatment behavioral strategies and successes and failures in preventing obesity The body composition that underlies obesity and the metabolic syndrome is key to understanding the problem The mechanisms by which energy balance is maintained is key to how the problem goes wrong The metabolic syndrome is in part a consequence of central fat storage but includes more issues such as insulin resistance low levels of inflammation and endothelial dysfunction This volume will cover evaluation guidelines different approaches to treatment including diet exercise behavior drugs and surgery to deal with the current world wide obesity epidemic

Nutrition and Metabolism Christos S. Mantzoros, 2009-04-20 Nutrition and Metabolism Underlying Mechanisms and Clinical Consequences brings together internationally recognized experts to comprehensively review our current understanding of how nutrition interacts with the genetic substrate as well as environmental exogenous factors including physical activity or the lack thereof to result in insulin resistance and the metabolic syndrome After presenting the scope of the problem the first major part of the book is devoted to genetics and pathophysiology the second part of the book presents the public health perspective of the most prevalent problems associated with nutrition and the metabolic syndrome whereas the third major part of the book focuses on clinical assessment and management of the main disease states associated with inappropriate nutrition and the metabolic syndrome Finally general information useful for both clinicians and researchers alike is presented in the Appendix Nutrition and Metabolism Underlying Mechanisms and Clinical Consequences offers the reader an up to date and authoritative review of the major scientific and clinical aspects of the overlapping areas between nutrition and metabolism

Genetic Endocrinology of the Metabolic Syndrome Santiago Rodríguez, 2009 Cardiovascular disease and mortality risk are significantly increased in people with metabolic syndrome a cluster of interrelated metabolic disorders including obesity insulin resistance glucose intolerance dyslipidemia and hypertension A complex interplay between predisposing and protective factors ultimately determines whether an individual will develop this set of disorders or not Genetic factors are one of the significant contributors that predispose to or protect against each component of the metabolic syndrome As in other complex diseases and traits such genetic factors are likely to be multiple and interacting with individual polymorphisms producing only a moderate effect The identification of genetic variants influencing the metabolic syndrome is of great importance to understanding pathogenesis identifying groups of individuals

with different relative risk and developing or improving therapies against this cluster of metabolic disorders. This has greatly stimulated both theoretical and applied genetic research in recent years. A range of new analytical tools has been developed for the dissection of complex traits. Applied genetic analyses have identified large numbers of candidate markers and chromosomal regions over 600 for obesity which represents only one of the disorders of this cluster. In this chapter the authors present a basic overview of the genetic approaches currently used for the identification of candidate genetic factors involved in the metabolic syndrome. The authors also summarise current evidence suggesting that genetic variants within elements of the endocrine system are directly involved in the risk of the metabolic syndrome. The authors focused their attention on endocrine pathways for which candidate genetic variants have been identified and they introduced the foundations of a new hypothesis which postulates the involvement of a network of endocrine genetic setpoints as a combined contributor to the risk of the metabolic syndrome.

The Ghrelin System A. Benso, F. F. Casanueva, E. Ghigo, R. Granata, 2013-04-22. The ghrelin story started more than 30 years ago with the discovery of synthetic GH secretagogues. Only in 1999 was ghrelin, a natural GH releasing peptide, discovered. Ghrelin, however, is much more than simply a natural GH secretagogue. In fact, this hormone is one of the most important factors known for regulating appetite and energy expenditure. Furthermore, ghrelin is the trigger for other neuroendocrine, metabolic, and nonendocrine actions. This book, written by researchers who provided the major contributions to our current knowledge of this complex system, gives a comprehensive overview of the recent advances in ghrelin research. The hormone's influence on the cardiovascular, metabolic, and gastroenteropancreatic system, hypothalamus, pituitary, adrenal axis, prolactin secretion, thyroid axis, gonadal axis, as well as on behavior, is discussed in detail. Furthermore, the clinical perspectives for ghrelin-derived therapeutic products are presented. Illustrating the tight interrelationship between endocrinology, metabolism, cardiovascular disease, and internal medicine, this book is essential reading for all scientists interested in appetite control, body weight, and energy expenditure, as well as diabetes mellitus and neuroendocrinology.

Endocrine and Metabolic Late Effects in Cancer Survivors Francesco Felicetti (Oncologist), Enrico Brignardello, Hanneke M. van Santen, 2021. This book analyzes in detail all aspects related to endocrine and metabolic late effects observed in patients treated for cancer, both in childhood and adulthood. The chapters focusing on the possible pathogenic mechanisms of late effects, i.e. premature aging and chronic inflammation, and on bone health in cancer survivors, are particularly interesting and innovative. The volume also deals with hypothalamic, pituitary, thyroid, and gonadal disorders, including infertility, and how to prevent it. Finally, the relationship between metabolic alterations and cardiovascular diseases in cancer survivors is addressed. Thanks to advances in cancer treatment and supportive care, the five-year survival rate of cancer patients is constantly increasing. However, this undisputable success of medicine has a flip side: the late adverse effects of anticancer therapies. Pediatric oncologists were the first to cope with late complications of treatments, but today, also adult oncologists and onco-hematologists recognize the relevance of this issue. Even though late

effects observed in cancer survivors can affect any organ or system endocrine and metabolic dysfunctions are the most frequently reported Endocrine complications rarely influence life expectancy of cancer survivors but they can significantly impact morbidity and quality of life Among endocrine adverse effects severe hypothalamic damage may be considered the most harmful in survivors leading to morbid obesity propensity to metabolic syndrome and cardiovascular disease This book aims to disseminate the knowledge about endocrine and metabolic adverse effects of cancer therapies and about survivorship care Since the number of cancer survivors is steadily growing in the general population this publication is intended not only for endocrinologists but also for oncologists onco hematologists internists pediatric specialists in those areas and general practitioners with the aim to better counsel and monitor cancer survivors

Metabolic Effects of Psychotropic Drugs J. Thakore, B. E. Leonard, Brian E. Leonard, 2009-07 Major depression and bipolar disorder are chronic enduring serious mental illnesses SMI with devastating effects on psychosocial functioning and may culminate in suicide Over the past years it has become apparent that subjects with these conditions can also develop the metabolic syndrome which is a series of obesity related physical conditions with an endocrine basis This book brings together reviews that help put into context exactly why subjects with SMI develop obesity prediabetic status overt type 2 diabetes mellitus and related cardiovascular events The relationship between prolactin and bone mineral density in subjects under medical treatment and the underlying dopaminergic mechanisms as well as the immunological changes occurring as an integral part of SMI and their effects on endocrine function are discussed and reviewed Psychiatrists diabetologists cardiologists family practitioners public health physicians as well as basic science researchers will find valuable guidelines when screening for type 2 diabetes mellitus and cardiovascular disease in SMI

Endocrine Surgery - Best Practice and Research Clinical Endocrinology and Metabolism - vol 15 n 2 June 2001 John R. Farndon, 2001

The Metabolic Syndrome: Barbara C. Hansen, George A. Bray, 2010-11-09 This book covers the most important clinical and bench science aspects of metabolic syndrome It will be of value to all of those seeking a comprehensive update on the metabolic syndrome Furthermore it will provide a broad basis for advancing research in the multiple intersecting disciplines encompassed by the metabolic syndrome

Inborn Metabolic Diseases Jean-Marie Saudubray, Matthias R. Baumgartner, John H. Walter, 2016-10-28 This work is recognised as the standard textbook for professionals involved in the diagnosis and management of inborn errors of metabolism IEM and an essential resource in this multidisciplinary field For the 6th edition all 43 chapters have been newly written or revised by authors with particular expertise in their subject areas Contents A clinical and biochemical approach to the recognition and diagnosis of IEM with algorithms to symptoms signs and syndromes in patients of all ages Emergency treatments Medications Separate comprehensive sections on IEM of Carbohydrates Mitochondrial Energy Amino and organic acids Vitamin responsive defects Neurotransmitter and Small peptides Lipid and Bile Acids Nucleic Acid and Heme Organelles Disorders affecting the synthesis and remodelling of complex lipids and fatty acid homeostasis are now included

Clinics in Endocrinology and

Metabolism ,1983 Endocrine Care of Children with Previous History of Cancer Charles A. Sklar,Wassim Chemaitilly,2019

This special topic issue addresses the most common endocrine and metabolic complications observed in cancer survivors It gives an overview to orient endocrinologists to common cancer diagnoses and the therapies most often associated with adverse endocrine outcomes Additionally it focuses on the important issues of impaired linear growth hypogonadism in males and females disorders of the thyroid gland diabetes mellitus and the metabolic syndrome hypothalamic obesity and disorders of the bone These state of the art reviews will hopefully assist clinicians in diagnosing and managing the various endocrine disorders experienced by survivors The goal is to improve quality of life and to reduce morbidity and mortality in a vulnerable population This publication is a valuable resource for pediatric adult and generalist providers caring for childhood cancer and brain tumor survivors

The Top Books of the Year Metabolic And Endocrine Emergencies Baillieres Clinical Endocrinology Metabolism S The year 2023 has witnessed a remarkable surge in literary brilliance, with numerous compelling novels captivating the hearts of readers worldwide. Lets delve into the realm of popular books, exploring the captivating narratives that have enthralled audiences this year. The Must-Read : Colleen Hoover's "It Ends with Us" This heartfelt tale of love, loss, and resilience has captivated readers with its raw and emotional exploration of domestic abuse. Hoover expertly weaves a story of hope and healing, reminding us that even in the darkest of times, the human spirit can triumph. Metabolic And Endocrine Emergencies Baillieres Clinical Endocrinology Metabolism S : Taylor Jenkins Reids "The Seven Husbands of Evelyn Hugo" This spellbinding historical fiction novel unravels the life of Evelyn Hugo, a Hollywood icon who defies expectations and societal norms to pursue her dreams. Reids captivating storytelling and compelling characters transport readers to a bygone era, immersing them in a world of glamour, ambition, and self-discovery. Metabolic And Endocrine Emergencies Baillieres Clinical Endocrinology Metabolism S : Delia Owens "Where the Crawdads Sing" This mesmerizing coming-of-age story follows Kya Clark, a young woman who grows up alone in the marshes of North Carolina. Owens crafts a tale of resilience, survival, and the transformative power of nature, entrancing readers with its evocative prose and mesmerizing setting. These bestselling novels represent just a fraction of the literary treasures that have emerged in 2023. Whether you seek tales of romance, adventure, or personal growth, the world of literature offers an abundance of captivating stories waiting to be discovered. The novel begins with Richard Papen, a bright but troubled young man, arriving at Hampden College. Richard is immediately drawn to the group of students who call themselves the Classics Club. The club is led by Henry Winter, a brilliant and charismatic young man. Henry is obsessed with Greek mythology and philosophy, and he quickly draws Richard into his world. The other members of the Classics Club are equally as fascinating. Bunny Corcoran is a wealthy and spoiled young man who is always looking for a good time. Charles Tavis is a quiet and reserved young man who is deeply in love with Henry. Camilla Macaulay is a beautiful and intelligent young woman who is drawn to the power and danger of the Classics Club. The students are all deeply in love with Morrow, and they are willing to do anything to please him. Morrow is a complex and mysterious figure, and he seems to be manipulating the students for his own purposes. As the students become more involved with Morrow, they begin to commit increasingly dangerous acts. The Secret History is a masterful and thrilling novel that will keep you guessing until the very end. The novel is a warning tale about the dangers of obsession and the power of evil.

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