

## Distal renal tubular dysfunction: a common feature in calcium stone formers

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**Abstract.** Distal renal tubular acidosis has been reported as an uncommon cause of urinary calcium stone disease. However, this defect appears to be more frequent when appropriate tests are performed systematically. Twenty-nine patients with recurrent calcium stones have been separated into three groups: normocalcaemic (group A), renal hypercalcaemic (group B) and absorptive hypercalcaemic (group C). Distal tubular functions were investigated by the (urine-blood)  $p\text{CO}_2$  gradient and by an ammonium chloride test. (Urine-blood)  $p\text{CO}_2$  gradient was (mean  $\pm$  SEM),  $3.33 \pm 0.59$  in group A,  $2.95 \pm 0.34$  in group B and  $3.31 \pm 0.58$  kPa in group C. All these values differ significantly from those observed in controls ( $4.11 \pm 0.28$  kPa;  $P < 0.05$ ). After 3 days of ammonium chloride loading, ammonium excretion averaged  $54.7 \pm 4.2$  in group A,  $54.4 \pm 4.3$  in group B and  $64.3 \pm 5.5$   $\mu\text{mol min}^{-1}$  in group C. Values obtained in the first two groups were significantly lower than that achieved by control subjects ( $76.4 \pm 14.9$   $\mu\text{mol min}^{-1}$ ). It is concluded that tubular dysfunctions defined as impairments in hydrogen ion secretion and ammonium excretion after an acid challenge are a common feature of the urinary calcium stone disease and play a contributory role in its pathogenesis.

**Key words.** Renal stones, renal tubular defects.

### Introduction

Complete distal renal tubular acidosis has been reported on few occasions as a cause of recurrent renal stones. Coe reviewed the literature in 1980 and recorded fourteen such cases to which he added six personal observations [1]. More recently, five cases of incomplete distal renal tubular acidosis associated with urolithiasis have been published by Konnak *et al.* [2]. The scarcity of these reports contrasts with the finding that elevated urinary pH is the third risk factor after hyperoxaluria and hypercalcaemia in calcium stone disease [3]. Furthermore, when distal renal tubular acidosis is present in hypercalcaemic subjects, it has been thought that the defect in urinary acidification was secondary to hypercalcaemia rather than a

primary dysfunction [4]. However, Backman *et al.*, studying by the short ammonium chloride loading test 310 consecutive recurrent renal stone formers, have found a much higher incidence of impaired acidification capacity than expected from reports of isolated case. Nineteen per cent of their patients with a female/male ratio of 2.9 had such a defect [5].

Therefore, the present study was designed: (a) to evaluate the prevalence of impaired acidification of the urine in patients with renal stones using the (urine-blood)  $p\text{CO}_2$  gradient, which allows the recognition of even discrete defect in tubular hydrogen ion secretion; and (b) to determine if this defect was a primary or a secondary phenomenon in calcium stone disease by comparing calcium stone formers with and without hypercalcaemia.

### Patients and Methods

Twenty-nine male patients with calcium recurrent urolithiasis were divided into three groups on the basis of a calcium loading test: normocalcaemic, group A ( $n=9$ ) (mean age  $43.5 \pm 4.6$  years), renal hypercalcaemic, group B ( $n=12$ ) (mean age  $38.5 \pm 9.5$  years) or absorptive hypercalcaemic, group C ( $n=8$ ) (mean age  $37.5 \pm 3.5$  years). All the patients were free from urinary tract infection at the time of the investigation. None of them presented an obstructive nephropathy during the month preceding the functional evaluation. This investigation was performed in ambulatory patients on their usual diet. After an overnight fast, the patients were asked to empty their bladder. The urine was discarded and thereafter a 2-h urine collection period was made between 0700 and 0900 h. At the end of this period, a standard breakfast was served along with a tablet containing 1 g of calcium (Calcium Sandoz® 1000) and urine collected again over a 4-h period. Calcium/creatinine ratio was determined in each period and citrate/creatinine ratio only in the first one. Results were interpreted according to a slight modification of the proposal of Pak *et al.* [6], described by Megevand & Chollet [7]. Normocalcaemic patients are those who had a normal calcium/creatinine ratio before and after calcium load; renal hypercalcaemic patients are defined as patients presenting an elevated calcium/creatinine ratio both before and after calcium

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# Renal Tubular Dysfunction Discussions In Patient Management

**Christine A. Gleason, Sandra E Juul**



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*Miller's Anesthesia* Lars I. Eriksson, 2009-01-01 From fundamental principles to advanced subspecialty procedures this text is the go to reference on the technical scientific and clinical challenges professionals face Features new chapters new authors meticulous updates an increased international presence and a new full color design **Hutchison's Atlas of Paediatric Physical Diagnosis** Krishna M Goel, Robert Carachi, 2019-02-28 This new edition provides paediatricians and trainees with a complete guide to the physical diagnosis of diseases and disorders in children Divided into 39 sections the book begins with an overview of paediatric history and examination growth and development neonatal medicine genetics and nutrition Each of the following sections covers diagnosis of disorders in different sub specialties Each case is presented in a step by step format describing aetiology pathology clinical features and differential diagnosis in depth The second edition has been fully revised and new chapters on podiatry surgical urology and neurosurgery added Edited by recognised Glasgow based experts this comprehensive atlas features more than 2000 clinical photographs diagrams and tables across nearly 1000 pages Key points Complete guide to diagnosis of paediatric diseases and disorders Fully revised second edition with new topics and more than 2000 images and illustrations Internationally recognised editor and author team Previous edition 9789351521525 published in 2014 *Henry's Clinical Diagnosis and Management by Laboratory Methods E-Book* Richard A. McPherson, Matthew R. Pincus, 2011-09-06 Recognized as the definitive book in laboratory medicine since 1908 Henry's Clinical Diagnosis and Management by Laboratory Methods edited by Richard A McPherson MD and Matthew R Pincus MD PhD is a comprehensive multidisciplinary pathology reference that gives you state of the art guidance on lab test selection and interpretation of results Revisions throughout keep you current on the latest topics in the field such as biochemical markers of bone metabolism clinical enzymology pharmacogenomics and more A user friendly full color layout puts all the latest most essential knowledge at your fingertips Update your understanding of the scientific foundation and clinical application of today's complete range of laboratory tests Get optimal test results with guidance on error detection correction and prevention as well as cost effective test selection Reference the information you need quickly and easily thanks to a full color layout many new color illustrations and visual aids and an organization by organ system Master all the latest approaches in clinical laboratory medicine with new and updated coverage of the chemical basis for analyte assays and common interferences lipids and dyslipoproteinemia markers in the blood for cardiac injury evaluation and related stroke disorders coagulation testing for antiplatelet drugs such as aspirin and clopidogrel biochemical markers of bone metabolism clinical enzymology hematology and transfusion medicine medical microbiology body fluid analysis and many other rapidly evolving frontiers in the field Effectively monitor the pace of drug clearing in patients undergoing pharmacogenomic treatments with a new chapter on this groundbreaking new area Apply the latest best practices in clinical laboratory management with special chapters on organization work flow quality control interpretation of results informatics financial

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Practice in Critical Care provides experiencedcritical care nurses with a clear and distinct evidence base forcontemporary critical care practice Central to the book is theapplication of research and evidence to practice and therefore case studies and key critical care clinical situations are usedthroughout to guide the reader through the patient care trajectory Each chapter introduces an initial patient scenario and as thechapter progresses the patient scenario develops with thetheoretical perspectives and application In this way it is evident how multi organ dysfunction develops impacting upon andinfluencing other body systems demonstrating the multi organimpact that is often experienced by the critically ill patient Inthis way consequences of critical illness such as acute renalfailure haemostatic failure and liver dysfunction are explored Throughout the text key research findings and critical caretreatment strategies are referred to applied and evaluated in thecontext of the given patient case study Advanced assessmenttechniques are explained and the underlying pathophysiology isdiscussed in depth Advanced Practice in Critical Care is anessential resource for experienced practitioners within criticalcare whom primarily care for patients requiring high dependency orintensive care      The 5-Minute Clinical Consult 2020 Sangeeta

Sharma,2019-12-15 Over 250 diagnostic and treatment algorithms over 900 topics providing clinical guidance current evidence based designations highlighted in each topic at a glance format with concise and bulleted text ICD 10 codes dsm 5criteria quick information to help in diagnosis treatment selection and medication dosing easy to use reference at point of care providing quick answer to a direct clinical question      *Sadikot's International Textbook of Diabetes* Kamlakar

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**Wilson Disease** Anna Czlonkowska, Michael Schilsky, 2017-04-18

Wilson Disease provides a comprehensive guide on this inherited genetic disorder that has devastating consequences for both the liver and neurologic/psychiatric health. This disease is of increasing interest to neurologists, hepatologists, and geneticists, but when the disease is diagnosed early it is treatable with patients living normal lives. This volume describes the molecular pathophysiology of WD and the clinical and pathological effects of copper. Separate sections address both diagnosis and medical and surgical approaches to treatment. Both adult and pediatric perspectives on diagnosis and treatment are addressed, and a section on genetics highlights advances in molecular diagnostics. Patient support groups that can aid in coping with this disease are also discussed, as are animal models for those interested in basic research on cell biology, pathophysiology, and treatment. Addresses the molecular pathophysiology of WD and the clinical and pathological effects of copper. Offers coverage of both diagnosis and medical and surgical approaches to treatment. Includes perspectives on both adult and pediatric diagnosis and treatment. Edited work with chapters authored by leaders in the field from around the globe, the broadest, most expert coverage available. *Cumulated Index Medicus*, 1966

**Avery's Diseases of the Newborn: First South Asia Edition-E-Book** Christine A. Gleason, Sandra E Juul, 2018-05-23

Covering the evaluation and management of every key disease and condition affecting newborns, Avery's Diseases of the Newborn by Drs Christine A. Gleason and Sandra E. Juul remains your 1 source for practical, clinically relevant information in this fast-changing field. You'll find the specific strategies you need to confidently diagnose and treat this unique patient population easy to use, single volume that focuses on key areas of practice. Now in a thoroughly revised First South Asia Edition, this highly respected reference is an authoritative clinical resource for neonatal practitioners. Provides up-to-date information on every aspect of newborn evaluation and management in a new, visually improved format featuring more than 500 all-new illustrations integrated within each chapter. Includes greatly expanded Neurology and Hematology sections that highlight the knowledge and expertise of new co-editor Dr. Sandra E. Juul. Features all new chapters on Palliative Care, Gastroesophageal Reflux, Platelet Disorders, Transfusion Therapy, Hypertension, and The Ear and Hearing Disorders, as well as expanded coverage of brain injury and neuroprotective strategies in the preterm and term infant. Contains new Key Points boxes at the beginning of every chapter. Brings you up to date on current topics such as the evolving epidemic of neonatal abstinence syndrome and the new clinical uses of ultrasound.

**Index Medicus**, 2004 Vols for 1963 include as pt 2 of the Jan issue Medical subject headings

**Neoplastic Diseases of the Blood** Peter H. Wiernik, Janice P. Dutcher, Morie A. Gertz, 2018-03-15 The new edition of this textbook integrates the history, epidemiology, pathology, pathophysiology, therapeutics, and supportive care of modern neoplastic hematopathology. Now in its sixth edition, this classic and invaluable text brings together a team of internationally renowned experts and offers in-depth coverage of the complex interface between diagnosis and therapy. The textbook is divided into five major sections, with the first four covering the spectrum of hematologic neoplasia, including

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,2015-11-26 Side Effects of Drugs Annual A Worldwide Yearly Survey of New Data in Adverse Drug Reactions was first published in 1977 and has been continually published as a yearly update to the voluminous encyclopedia Meyler's Side Effects of Drugs Each Annual provides clinicians and medical investigators with a reliable and critical survey of new data and trends in the area of adverse drug reactions and interactions with an international team of specialists contributing their expertise each year Provides a critical yearly survey of the new data and trends regarding the side effects of drugs Authored and reviewed by pioneers throughout the world in the clinical and practice sciences Presents an essential clinical on the side effects of drugs for practitioners and healthcare professionals *Medical-Surgical Nursing* Sharon L. Lewis, RN, PhD, FAAN, Linda Bucher, Margaret M. Heitkemper, RN, PhD, FAAN, Shannon Ruff Dirksen, RN, PhD, 2013-12-02 Over the past three decades more and more nursing educators have turned to Lewis Medical Surgical Nursing for its accurate and up to date coverage of the latest trends hot topics and clinical developments in the field of medical surgical nursing and the new ninth edition is no exception Written by a dedicated team of expert authors led by Sharon Lewis Medical Surgical Nursing 9th Edition offers the same easy to read style that students have come to love along with the timely and thoroughly accurate content that educators have come to trust Completely revised and updated content explores patient care in various clinical settings and focuses on key topics such as prioritization critical thinking patient safety and NCLEX exam preparation Best of all a complete collection of interactive student resources creates a more engaging learning environment to prepare you for clinical practice Highly readable format gives you a strong foundation in medical surgical nursing Content written and reviewed by leading experts in the field ensures that the information is comprehensive current and clinically accurate Bridge to NCLEX Examination review questions at the end of each chapter reinforce key content while helping you prepare for the NCLEX examination with both standard and alternate item format questions UNIQUE Levels of Care approach explains how nursing care varies for different levels of health and illness More than 50 comprehensive nursing care plans in the book and online incorporate NIC NOC and current NANDA diagnoses defining characteristics expected outcomes specific nursing interventions with rationales evaluation criteria and collaborative problems Over 800 full color illustrations and photographs clearly demonstrate disease processes and related anatomy and physiology NEW Unfolding case studies included throughout each assessment chapter help you apply important concepts and procedures to real life patient care NEW Managing Multiple Patients case studies at the end of each section give you practice applying your knowledge of various disorders and help you

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**Fundamentals of Urine and Body Fluid Analysis - E-Book** Nancy A. Brunzel, 2012-03-23 Renowned for its clear writing style logical organization level and depth of content and excellent color illustrations Fundamentals of Urine Body Fluid Analysis 3rd Edition covers the collection and analysis of urine fecal specimens vaginal secretions and other body fluids such as cerebrospinal synovial seminal amniotic pleural pericardial and peritoneal fluids Expert author Nancy Brunzel shares her extensive knowledge and expertise in the field presenting key information and essential techniques and procedures as well as easy to grasp explanations of how to correlate data with basic anatomy and physiology to understand pathological processes Vaginal Fluid Analysis chapter covers vaginal wet preps a topic not found in many other references Case studies help you understand how key concepts apply to real world practice Full color images and photomicrographs show you what you should see under the microscope An image glossary presents 94 additional images to help you identify rare and common cells Multiple choice questions at the end of every chapter allow you to test your understanding of the material A glossary at the end of the book offers quick access to key terms and definitions NEW Automation of Urine and Body Fluid Analysis chapter helps you understand the automated procedures being used in more and more labs NEW Body Fluid Analysis Manual Hemacytometer Counts and Differential Slide Preparation chapter ensures you know how to perform manual analysis methods UPDATED Coverage of the latest instrumentation keeps you up to date with the technology used in today's laboratories **Meyler's Side Effects of Drugs** Jeffrey K. Aronson, 2015-10-15 Meyler's Side Effects of Drugs The International Encyclopedia of Adverse Drug Reactions and Interactions Sixteenth Edition Seven Volume Set builds on the success of the 15 previous editions providing an extensively reorganized and expanded resource that now comprises more than 1 500 individual drug articles with the most complete coverage of adverse reactions and interactions found anywhere Each article contains detailed and authoritative information about the adverse effects of each drug with comprehensive references to the primary literature making this a must have reference work for any academic or medical library

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