

## Review

# Exploring the Utility of Renal Resistive Index in Critical Care: Insights into ARDS and Cardiac Failure

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**Abstract:** The renal resistive index (RRI), a Doppler ultrasound-derived parameter measuring renal vascular resistance, has emerged as a promising non-invasive tool to evaluate renal hemodynamics in critically ill patients, particularly those with acute respiratory distress syndrome (ARDS) and heart failure (HF). This narrative review examines the current evidence for RRI measurement in these conditions, exploring its physiological bases, methodology, clinical applications, and limitations. In ARDS, RRI reflects the complex interactions between positive pressure ventilation, hypoxemia, and systemic inflammation, showing a role in predicting acute kidney injury and monitoring response to interventions. In HF, RRI is able to assess venous congestion and cardiorenal interactions and can also serve as a prognostic indicator. Many studies have shown RRI's superiority or complementarity to traditional biomarkers in predicting renal dysfunction, although its interpretation requires consideration of multiple patient-related factors. Key challenges include operator dependency, lack of standardization, and complex interpretation in multi-organ dysfunction. Future research should focus on measurement standardization, development of automated techniques, investigation of novel applications like intraparenchymal renal resistive index variation, and validation of RRI-guided management strategies. Despite its limitations, RRI represents a valuable tool that offers bedside and real-time insights into renal hemodynamics and potential guidance for therapeutic interventions. Further research is needed to fully clarify its clinical potential and address current limitations, particularly in critical care settings involving multiple organ dysfunction.

**Keywords:** renal resistive index; critical care; ARDS; heart failure; duplex Doppler sonography



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## 1. Introduction

Renal resistive index (RRI), an ultrasound vascular Doppler-derived parameter, evaluates renal resistance and compliance; it was first described by Pourcelot in 1974 [1,2].

RRI was primarily explored as a diagnostic tool in situations in which intrarenal impedance is altered, particularly renovascular and chronic kidney disease; however, it

# Renal Problems In Critical Care

**Michael James Murray**



## **Renal Problems In Critical Care:**

*Renal Problems in Critical Care* Lynn Schoengrund, Pamela Balzer, 1985 A comprehensive source for the critical care nurse dealing with patients with acute renal failure The book includes anatomy and physiology of the normal kidney pathophysiology of acute renal failure nutritional needs and drug therapy in renal failure treatment of renal failure and specific nursing interventions for all treatments

*Critical Care Nephrology* Claudio Ronco, Rinaldo Bellomo, John A. Kellum, 2009-01-01 This 2nd edition of Critical care nephrology continues to provide comprehensive coverage of the latest advances in critical care procedures for the adult or pediatric patient with renal diseases or disorders It presents a common language and standardized guidelines to help multi disciplinary physicians caring for the critically ill communicate more effectively

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*Critical Care Nephrology E-Book* Claudio Ronco, Rinaldo Bellomo, John Kellum, Zaccaria Ricci, 2017-12-14 Comprehensive and clinically relevant the 3rd Edition of Critical Care Nephrology provides authoritative coverage of the latest advances in critical care procedures for patients with renal diseases or disorders Using common guidelines and standardized approaches to critically ill patients this multidisciplinary reference facilitates better communication among all physicians who care for critically ill patients suffering from kidney disease electrolyte and metabolic imbalances poisoning severe sepsis major organ dysfunction and other pathological events Offers detailed discussions of different forms of organ support artificial organs infections acute illness occurring in chronic hemodialysis patients and much more Places a special emphasis on therapeutic interventions and treatment procedures for a hands on clinical reference tool Presents information clearly in a format designed for easy reference from basic sciences to clinical syndromes to diagnostic tools Covers special populations such as children diabetic patients and the elderly An exceptional resource for nephrologists intensivists surgeons or critical care physicians anyone who treats critically ill renal patients Shares a combined commitment to excellence lead by Drs Claudio Ronco Rinaldo Bellomo John Kellum and Zaccaria Ricci unparalleled leaders in this field Addresses key topics with expanded coverage of acute kidney injury stress biomarkers and sepsis including the latest developments on mechanisms and management Provides up to date information on extracorporeal therapies from new editor Dr Zaccaria Ricci Expert Consult™ eBook version included with purchase This enhanced eBook experience allows you to search all of the text figures and references from the book on a variety of devices

Textbook of Critical Care Yatin Mehta, 2015-08-31 Textbook of Critical Care is an extensive two volume guide to all aspects of critical care The first volume covers systems of the human body in individual sections the second volume continues to cover other vital topics for those working in an intensive care unit The two volumes are subdivided into fourteen sections

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objective data and expert guidance on managing critically ill patients in unique question based chapters that focus on best practices Now thoroughly updated by Drs Clifford S Deutschman Patrick J Neligan and nearly 200 critical care experts this highly regarded title remains the only book of its kind that provides a comprehensive framework for translating evidence into practice making it a valuable resource for both residents and practitioners Tap into the expertise of nearly 200 critical care experts who discuss the wide variety of clinical options in critical care examine the relevant research and provide recommendations based on a thorough analysis of available evidence Think through each question in a logical efficient manner using a practical consistent approach to available management options and guidelines Find the information you need quickly with tables that summarize the available literature and recommended clinical approaches Navigate a full range of challenges from routine care to complicated and special situations Stay up to date with new issues and controversies such as the redefinition of sepsis changing approaches to fluid administration immune suppression in sepsis monitoring the microcirculation the long term sequelae of critical illness minimizing ventilator associated lung injury the benefits of evidence based medicine management guidelines rapid response teams and more Benefit from all new sections covering persistent critical illness and the role of advanced practice nurses and physician assistants in the ICU

**Oxford Textbook of Critical Care** Derek Angus, Simon Finfer, Luciano Gattioni, Mervyn Singer, 2019-12-03 Now in paperback the second edition of the Oxford Textbook of Critical Care addresses all aspects of adult intensive care management Taking a unique problem orientated approach this is a key resource for clinical issues in the intensive care unit

**AACN Advanced Critical Care Nursing - E-Book Version to be sold via e-commerce site** American Association of Critical-Care Nurses, AACN, 2008-04-24 From AACN experts comes a resource dedicated to helping you oversee or care for critical care patients in any practice setting This comprehensive critical care nursing textbook addresses serious and potentially life threatening patient conditions with a foundation rooted in the critical thinking process the comprehension analysis synthesis and application of knowledge Endorsed by the American Association of Critical Care Nurses AACN the largest specialty nursing organization in the United States for the most authoritative coverage available Thorough discussions of each body system emphasize advanced concepts presenting physiology in an application format that examines the clinical implications of physiological science Coverage of assessment focuses on interpreting abnormal findings and linking those findings to diagnosis and intervention Appropriate interventions are discussed from an interdisciplinary evidence based perspective Hundreds of new full color illustrations and design clarify important concepts and improve the book s usability Complex unfolding case studies are presented in all disease chapters accompanied by review questions with a comprehensive answer key Multidisciplinary Plans of Care provide at a glance information for common ICU conditions Nutrition boxes appear in each relevant chapter offering guidelines for patient needs with specific illnesses Research Based Practice Guidelines boxes and Promoting Evidence Based Practice features appear throughout the text whenever applicable to present the latest

research supported nursing assessment and intervention practices Drug boxes include common classifications of critical care drugs for specific disorders including drug actions dosage and special considerations Applying the Technology features help you apply the latest technology to patient care NIC Interventions boxes list NIC intervention labels appropriate for the conditions discussed in a chapter

*Controversies in Intensive Care Medicine* Ralf Kuhlen,2008 In recent years many clinical interventions in intensive care medicine have been based on clear scientific evidence However at least as many clinical interventions still remain the subject of controversy either due to a lack of rigorous data or due to the existence of conflicting data In this book these controversies are discussed by experts of international renown in their respective fields The goal is twofold To provide us with a balanced and unbiased presentation of the subject explaining the different schools of thought relevant to the controversy To summarise the data with a clinically useful and valid recommendation for our practice Virtually all fields of intensive care medicine are covered in over 50 chapters dealing with controversies over treatment options in acute illness states organising and providing care for acutely ill patients as well as how to answer ethical questions arising in critical care medicine every day

*Advanced Practice in Critical Care* Sarah McGloin,Anne McLeod,2010-04-26 Advanced Practice in Critical Care provides experienced critical care nurses with a clear and distinct evidence base for contemporary critical care practice Central to the book is the application of research and evidence to practice and therefore case studies and key critical care clinical situations are used throughout to guide the reader through the patient care trajectory Each chapter introduces an initial patient scenario and as the chapter progresses the patient scenario develops with the theoretical perspectives and application In this way it is evident how multi organ dysfunction develops impacting upon and influencing other body systems demonstrating the multi organ impact that is often experienced by the critically ill patient In this way consequences of critical illness such as acute renal failure haemostatic failure and liver dysfunction are explored Throughout the text key research findings and critical care treatment strategies are referred to applied and evaluated in the context of the given patient case study Advanced assessment techniques are explained and the underlying pathophysiology is discussed in depth Advanced Practice in Critical Care is an essential resource for experienced practitioners within critical care whom primarily care for patients requiring high dependency or intensive care

Textbook of Pulmonary and Critical Care Medicine SK Jindal,2017-07-17 The second edition of the comprehensive two volume set brings respiratory medicine specialists fully up to date with the latest advances and information in their field Beginning with an introduction to lung development and physiology of the respiratory system the next chapters discuss pharmacology symptoms and respiratory diagnosis Each of the following sections is dedicated to a specific type of respiratory disease or infection further divided to provide in depth detail on every aspect of the topic The text also explains how each respiratory disorder may be associated with other medical specialities such as critical care cardiology sleep medicine and infectious diseases This two volume set features numerous pulmonary radiographs including CT nuclear images bronchoscopy and

thoracoscopy as well as tables and diagrams to enhance learning Key Points Fully updated new edition of two volume set providing latest advances in pulmonary and critical care medicine Covers numerous respiratory diseases and infections and their comorbidity with other medical specialties Highly illustrated with radiographic images tables and diagrams Previous edition 9789350250730 published in 2011 *Priorities in Critical Care Nursing - E-Book* Linda D. Urden, Kathleen M. Stacy, Mary E. Lough, 2013-12-27 *Priorities in Critical Care Nursing* 6th Edition is the perfect companion to any critical care course with its succinct coverage of all core critical care nursing topics Using the latest most authoritative research this evidence based resource helps you identify priorities to accurately and effectively manage patient care Updated content spans the areas of medication patient safety patient education nursing diagnosis and collaborative management to fully prepare you for success in all aspects of critical care nursing Evidence based approach offers the most accurate and timely patient care recommendations based on the latest and most authoritative research meta analyses and systematic reviews available Patient Safety Priorities boxes in each therapeutic management chapter highlight important patient safety considerations UNIQUE Nursing Diagnosis Priorities boxes list the most urgent potential nursing diagnoses with a page reference to the corresponding Nursing Management Plan Nursing Management Plans provide you with a complete care plan for every Priority Diagnosis that includes the diagnosis definition defining characteristics outcome criteria nursing interventions and rationales Evidence Based Collaborative Practice boxes summarize evidence based recommendations for a variety of therapies Collaborative Management boxes guide you through the management of a wide variety of disorders Patient Education boxes list the concepts that must be taught to the patient and the family before discharge from the ICU Concept maps help you understand common critical health conditions including acute coronary syndrome acute renal failure ischemic stroke and shock NEW Case studies with critical thinking questions test your understanding of key concepts and their practical applications NEW Priority Medication boxes give you a foundation in the pharmacology used most in critical care UPDATED New information on the management of the alcoholic patient and disorders resulting from alcoholism is added to chapter nine **Pediatric Critical Care Medicine** Derek S. Wheeler, Hector R. Wong, Thomas P. Shanley, 2014-07-03 This second edition spans four volumes with major sections dedicated to specific organ systems Each major section consists of separate chapters dedicated to reviewing the specific disease processes affecting each organ system Each chapter concludes with a comprehensive list of references with brief concise remarks denoting references of special interest and of interest Consequently the books are unique in their comprehensive coverage of pediatric critical care and their ease of use and will be of value to those studying towards pediatric critical care examinations and those who are already qualified Intensive Care in Nephrology Patrick Murray, Hugh Brady, Jesse B. Hall, 2005-11-03 The field of intensive care in nephrology is a rapidly evolving one with research starting to translate into clinical guidelines and standards Encompassing core subjects in critical care and nephrology as well as specific related consultative topics this clearly

presented text is organized into three sections focusing on up to date background      Blood Purification in Intensive Care  
Claudio Ronco,Rinaldo Bellomo,G. La Greca,2001-01-01 In the last twenty years critical care medicine has been established as a specialty with its own therapies and procedures with significant implications for clinical nephrology regarding severe acute renal failure This typically multi factorial condition is today predominantly seen in intensive care units The complex knowledge and skills necessary to handle it have resulted in a field called Critical Care Nephrology where nephrologist and intensivist either work side by side or have formally acquired expertise and training in both specialties Extracorporeal renal replacement therapies although originally used to treat end stage renal disease patients rapidly gained importance for acute patients This has had far reaching implications for the initiation and possible role of blood purification in the management of critically ill patients widening the scope of interaction between the nephrologist and the intensivist Experts in the field have contributed to the present book providing a comprehensive review of the different blood purification techniques relevant in the intensive care unit in the case of multiple organ failure The resulting mix of established knowledge and recent results from both clinical trials and basic research constitutes a valuable tool for all professionals involved in the care of the critically ill patient

**Blood Purification in Intensive Care** C. Ronco,R. Bellomo,Claudio Ronco,G. La Greca,2001-07 In the last twenty years critical care medicine has been established as a specialty with its own therapies and procedures with significant implications for clinical nephrology regarding severe acute renal failure This typically multi factorial condition is today predominantly seen in intensive care units The complex knowledge and skills necessary to handle it have resulted in a field called Critical Care Nephrology where nephrologist and intensivist either work side by side or have formally acquired expertise and training in both specialties Extracorporeal renal replacement therapies although originally used to treat end stage renal disease patients rapidly gained importance for acute patients This has had far reaching implications for the initiation and possible role of blood purification in the management of critically ill patients widening the scope of interaction between the nephrologist and the intensivist Experts in the field have contributed to the present book providing a comprehensive review of the different blood purification techniques relevant in the intensive care unit in the case of multiple organ failure The resulting mix of established knowledge and recent results from both clinical trials and basic research constitutes a valuable tool for all professionals involved in the care of the critically ill patient

**Annual Update in Intensive Care and Emergency Medicine 2017** Jean-Louis Vincent,2017-03-31 The Annual Update compiles reviews of the most recent developments in experimental and clinical intensive care and emergency medicine research and practice in one comprehensive reference book The chapters are written by well recognized experts in these fields The book is addressed to everyone involved in internal medicine anesthesia surgery pediatrics intensive care and emergency medicine

*Management of Acute Kidney Problems* Achim Jörres,Claudio Ronco,John A. Kellum,2010-03-11 Acute kidney failure is an important clinical area in the intensive care unit setting An estimated 5 20% of critically ill patients experience an episode of



acute kidney failure during the course of their illness and about 5% of patients admitted to an ICU will eventually require renal replacement therapy. In these patients, in-hospital mortality is extremely high, exceeding 50%. Thus, the early detection and causal treatment of acute kidney problems is vitally important for a successful outcome. Written by internationally renowned experts, this clinical reference offers helpful advice with the most recent information on the definition, epidemiology, pathophysiology, and clinical causes of acute kidney failure as a fundamental prerequisite for prevention of this disorder. Moreover, it also covers differential diagnostic approaches for patients with acute renal failure and provides a detailed outline of important measures for their clinical management. Finally, separate chapters are dedicated to various key aspects related to the adequate delivery of acute renal replacement therapy. It is intended as a helpful guide for all clinicians involved in the care of patients at risk of developing acute kidney problems.

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