

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

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*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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*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 **ACCCN's Critical Care Nursing** Leanne Aitken,Andrea Marshall,Wendy Chaboyer,2016-01-04 With each edition ACCCN s Critical Care Nursing has built on its highly respected reputation Its contributors aim to encourage and challenge practising critical care nurses and students to develop world class critical care nursing skills in order to ensure delivery of the highest quality care Endorsed by the Australian College of Critical Care Nurses ACCCN this 3rd edition presents the expertise of foremost critical care leaders and features the most recent evidence based research and up to date advances in clinical practice technology procedures and standards Expanded to reflect the universal core elements of critical care nursing practice authors Aitken Marshall and Chaboyer have retained the specific information that captures the unique elements of contemporary critical care nursing in Australia New Zealand and other similar practice environments Structured in three sections ACCCN s Critical Care Nursing 3rd Edition addresses all aspects of critical care nursing including patient care and organisational issues while highlighting some of the unique and complex aspects of specialty critical care nursing practice such as paediatric considerations trauma management and organ donation Presented in three sections Scope of Critical Care Principles and Practice of Critical Care Speciality Practice Focus on concepts that underpin practice essential physical psychological social and cultural care New case studies elaborate on relevant care topics Research vignettes explore a range of topics Practice tips highlight areas of care particularly relevant to daily clinical practice Learning activities support knowledge reflective learning and understanding Additional case studies with answers available on evolve NEW chapter on Postanaesthesia recovery Revised coverage of metabolic and nutritional considerations for the critically ill patient Aligned with the NEW ACCCN Standards for Practice **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 with 112 chapters in total The book begins with general principles before covering cardiovascular respiratory renal and gastrointestinal systems as well as neurology and endocrinology The post surgical critical care section includes a range of surgeries and organ transplants Further topics include obstetric critical care

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**Critical Care Medicine** Michael James Murray, 2002 This authoritative reference published under the auspices of the American Society of Critical Care Anesthesiologists ASCCA is now in its Second Edition More than 100 internationally recognized experts present state of the art strategies for successful cost effective perioperative care and management of acutely ill patients This thoroughly revised edition features many distinguished new contributors from anesthesiology critical care medicine internal medicine surgery and pediatrics Timely new chapters cover medical informatics evidence based medicine human genomics research in critical care medicine and imaging in the ICU Chapters on acute respiratory distress syndrome sepsis and other diseases have been rewritten to reflect recent technological and therapeutic breakthroughs

Critical Care Study Guide Gerard J. Criner, Rodger E. Barnette, Gilbert E. D'Alonzo, 2010-06-27 Critical care medicine is a dynamic and exciting arena where complex pathophysiologic states require extensive knowledge and up to date clinical information An extensive knowledge of basic pathophysiology as well as awareness of the appropriate diagnostic tests and treatments that are used to optimize care in the critically ill is essential Since our first edition 7 years ago new information crucial to the care and understanding of the critically ill patient has rapidly accumulated Because this knowledge base crosses many different disciplines a comprehensive multidisciplinary approach presenting the information is essential similar to the multidisciplinary approach that is used to care for the critically ill patient We have strived to provide this content in an easily digestible format that uses a variety of teaching tools to facilitate understanding of the presented concepts and to enhance information retention To meet the demand to provide comprehensive and diverse education in order to understand the pathogenesis and optimum care of a variety of critical illnesses we have substantially revised the prior topics in the first edition with updated information We have also markedly expanded the number of topics covered to include acute lung injury and the acute respiratory distress syndrome an expanded discussion of the physiology and operation of mechanical ventilation obstetrical care in the ICU neurosurgical emergencies acute coronary syndromes cardiac arrhythmias role of whole body rehabilitation in the ICU ethical conduct of human research in the ICU and nursing care of the ICU patient

**Evidence-Based Practice of Critical Care E-Book** Clifford S. Deutschman, Patrick J. Neligan, 2015-11-26 Evidence Based Practice of Critical Care 2nd Edition presents 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

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**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

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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

**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

*ACCCN's Critical Care Nursing* Doug Elliott, Leanne Aitken, Wendy Chaboyer, Andrea Marshall, 2011-11-21

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**Core Knowledge in Critical Care Medicine**

Wolfgang Krüger, Andrew James Ludman, 2014-08-25 This book provides a detailed review of state of the art knowledge on critical care topics as well as the latest research findings It covers the core aspects in excellent detail but is not so comprehensive as to make its daily use unfeasible For each condition considered discussion of the pathophysiology is integrated with observations on diagnosis and treatment in order to allow a deeper understanding The book is scientifically based with extensive references to published research This will allow readers to investigate their individual interests further and will enable physicians to justify measures by providing a coherent evidence based strategy and relevant citations where needed Core Knowledge in Critical Care Medicine will appeal to experienced practitioners as an aide m moire but will also be of great value to a wide range of more junior staff wishing to complement their background knowledge with important facts



applicable to everyday practice      *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 specialties 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      **Patient Transport: Medical Critical Care - E-Book** Air & Transport Nurses Association (ASTNA),Allen Wolfe,Michael Frakes,Danny Nayman,2024-11-10 An ideal companion to the

award winning Patient Transport Principles Practice 6th Edition this critical care transport text offers a unique focus on the critical care patient in transit addressing the needs of flight and ground transport registered nurses paramedics and those preparing for certification exams such as CFRN CTRN FP C and CCP C Authored by the esteemed Air and Surface Transport Nurses Association ASTNA this comprehensive guide is backed by the expertise of a leading body representing transport nurses worldwide making it an indispensable resource in the evolving landscape of critical care transport Coverage of injuries commonly encountered in flight and ground nursing includes pathophysiology assessment planning implementation and evaluation discussions Part I covers critical care medicine and Part II covers selected patient populations Meets the needs of all healthcare providers dedicated to expert care delivery in transport including nurses paramedics physicians respiratory therapists pilots mechanics and communication specialists Real life scenarios with updated technology demonstrate how to apply concepts to scenarios like those seen in practice Focus on the interprofessional and collaborative nature of transport emphasizes the importance of teamwork in ensuring successful patient outcomes Evolve companion website with 200 certification style questions provides valuable exam review and practice

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