Caring for the Critically Ill Patient: Challenges and Opportunities

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For a quarter century, JAMA has served as a venue for articles relating to care of critically ill patients, beginning with the Concepts in Emergency and Critical Care section, in which these fields were initially described as “spanking new medical disciplines.” At the time, knowledge of the biology of critical illness was rudimentary, the focus was on initial patient care, such as airway management and resuscitation, and the few physicians trained in emergency or critical care medicine worked mainly in large teaching hospitals. During the following years, critical care and emergency medicine grew rapidly, training and accreditation became more standardized, and the focus changed to the definition, management, and outcome of postresuscitation syndromes, such as sepsis, shock, and organ dysfunction. Approximately 10 years ago, the section name was changed to Caring for the Critically Ill Patient, ushering in increased focus on high-quality multicenter randomized trials, organization and delivery of care, and attention to patient-centered outcomes.

Today, the Caring for the Critically Ill Patient section of JAMA is devoted to publication of important articles in critical and emergency care at a time when the clinical and research landscape has shifted again. Advances in molecular biology now provide a wealth of information on the humoral and cellular responses to acute trauma, infection, and ischemia. This understanding has helped delineate the mechanisms of shock, sepsis, and organ dysfunction syndromes, such as acute respiratory distress syndrome (ARDS), acute renal failure, and traumatic brain injury, generating a plethora of therapeutic targets. The scale of critical care and emergency medicine services has also changed. Every acute care hospital in the United States boasts an intensive care unit (ICU), half of the nation’s ICU beds are located in small hospitals, and many teaching hospitals have built huge ICU services, often with 60 or more beds. Six million Americans, or 2% of the population, are admitted to the ICU each year, severe sepsis and ARDS affect hundreds of thousands of individuals annually, and 1 in 5 Americans receive ICU care at the end of life. All this care is provided by a workforce of hundreds of thousands of highly trained physicians, nurses, and allied health care personnel who function in integrated team systems, not just in the ICU and emergency department, but increasingly on hospital general units and in the community.

With substantial investment of resources and advancement in knowledge, care of critically ill patients has no doubt improved. Mortality appears to have decreased for sepsis and ARDS, and headway has been made toward safer, quicker, more effective care. However, considerable challenges lie ahead on the path from basic science to improved public health, including a translational block between basic science and clinical trials; challenges in conducting clinical trials in critically ill patients; failure of clinical research to fully frame health issues facing critically ill patients; an inadequate evidence base for many aspects of care; and public health policy that is either lacking or uninformed by evidence.

The first challenge, overcoming translation from basic science to clinical trials, is exemplified by the sepsis syndromes. Among the more than 30 large trials involving agents designed to modify the host response to infection, only 2 were positive (and neither of these are considered definitive). While trial design may be partly to blame, the problems run deeper. Severe sepsis, the subset of sepsis with acute organ dysfunction, is often difficult to define and encompasses a highly heterogeneous group of patients. Outcome and probably response to therapy are linked to multiple host, pathogen, and health care–related factors that neither in vitro nor in vivo models adequately address. Therapies enter clinical trials with little information on appropriate dosing or methods to monitor their biologic activity. A particular challenge for sepsis and other critical illnesses is that the pathways targeted for modification are as often helpful as harmful, and current clinical trial entry criteria provide no guarantee that the host response pathway of interest is either active in a particular patient or behaving in an injurious manner. Thus, clinical research needs better tools to select and monitor patients and their therapies, and basic science needs to more quickly, more effective care.

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to produce data that are more informative on the likely behavior of a chosen therapy in humans.

Second, conducting clinical trials involving critically ill patients is a major challenge. Critically ill patients are a vulnerable population, often unable to give consent, yet the clinical stakes are high as the proposed interventions could have a large and immediate effect on survival. Many interventions are developed by pharmaceutical and biotechnology companies, requiring transparent collaborations between industry and academia with attention to design, oversight, analysis, and reporting. Many other interventions gaining interest are complex combinations of care, such as resuscitation algorithms, medical emergency response teams, or bundles of care for prevention of nosocomial infection. These complex interventions are difficult to study: patient-level randomization and blinding may not be practical; the intervention may be introduced variably in different sites; and care of patients in the control group may be difficult to classify, define, or measure, complicating interpretation of treatment effect.

Third, clinical research often fails to frame patients’ health needs. Although the traditional focus of critical care has been to improve short-term mortality, survivors may develop chronic physical, neurocognitive, and mood disorders, with important consequences for their function and quality of life. These outcomes may be necessary to measure in clinical trials and may represent bona fide primary targets. However, many of these problems may exist before ICU admission. Chronic illness can precipitate acute illness, but the acute event in turn may destabilize the chronic illness or change its subsequent trajectory. Such relationships are not easily understood when studies are limited to recruitment of patients in the ICU and will require longitudinal studies of patients at risk of developing critical illness. A longitudinal approach will also facilitate better understanding of when and whether emergency and intensive care should be deployed, and the patient and family preferences for such care. Often, the appropriate goal may not be an improvement in morbidity and mortality at all, but rather an improvement in the quality of end-of-life care.

Fourth, despite their high cost, emergency and critical care services are often delivered without rigorous assessment. Perhaps the most noteworthy example is the pulmonary artery (PA) catheter. Use of the PA catheter was a defining element of critical care for decades, yet only recently was its use tested in randomized trials, none of which found benefit. Possibly as a consequence, use of the PA catheter has declined dramatically over the past decade, as reported by Wiener and Welch in this issue of JAMA. Although the trials do not settle the controversy surrounding the PA catheter, they highlight, as Rubenfeld et al point out, that its benefits, if any, are not easily harnessed. Recent studies of many other parts of routine critical care, such as diagnostic workups, choice and mode of organ support, use of sedatives and antibiotics, and management of nutrition, fluid, and electrolytes, have similarly exposed wide variance in practice and challenged existing dogma. The benefits of any new diagnostic, monitoring, or organ support techniques will likely be equally elusive if not used and evaluated with great care.

Fifth, from a policy perspective, neither the number nor the staffing of ICU beds is standardized or coordinated for population needs, possibly resulting in inefficiencies and lack of access, especially for vulnerable populations. As the population ages and health care costs continue to increase, supply-demand relationships may worsen if not coordinated. Regionalized care models, such as neonatal intensive care and trauma care, help to ensure that the sickest patients are treated at centers with the highest capabilities, but no such approach exists for most adult intensive care services. Given the challenges of working in these intense environments, it is also important to ensure the attraction, education, and retention of a stable workforce with the appropriate technical, communication, and leadership skills.

Caring for critically ill patients has become a large and complex part of health care with a challenging research agenda. Regardless of whether a proposed improvement in care is a drug, a complex algorithm, a bundle of care, or an organizational change, efforts to confirm its benefits, isolate its mechanisms of action, and determine strategies that promote its optimal dissemination and integration into practice are all crucial. JAMA looks forward to helping this endeavor by publishing rigorous, high-quality articles on the issues outlined above, as well as on virtually any topic relevant to critical care. We therefore encourage authors to submit manuscripts that report basic experimental studies that directly address the mechanisms, diagnosis, or treatment of critical illness; clinical trials and observational clinical studies directed at understanding or improving the health of critically ill patients and their families; health services and policy studies of the organization and delivery of emergency and critical services; and pertinent methodological applications and advances. The Caring for the Critical Ill Patient section of JAMA will continue to serve as a venue for wide dissemination of important articles relating to the science and practice of emergency and critical care medicine, with the ultimate goal of promoting the best possible outcomes for all affected by critical illness.

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The Pulmonary Artery Catheter, 1967–2007
Rest in Peace?

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In this issue of JAMA, an investigation using a nationally representative administrative database reported a marked decline in the use of the pulmonary artery (PA) catheters from 5.66 per 1000 medical admissions in 1993 to 1.99 per 1000 medical admissions in 2004. These significant declines in PA catheter utilization were most prominent for patients with myocardial infarction (81% decrease), but also were significant for surgical patients (63% decrease) and for patients with sepsis (54% decrease).

These national data are consistent with trends at our institution, an academic public hospital and level 1 trauma center with 75 intensive care unit (ICU) beds with a relatively low volume of patients with acute myocardial infarction. For example, from July 2002 to May 2003, the hospital billed patients for 871 PA catheters. Although the ICU census has increased, the use of PA catheters has declined to 262 catheters from July 2006 to May 2007. Recently, nurses and residents gathered around the bedside of the sole patient in the medical ICU with a PA catheter so they could actually observe one in use. If the demise of the PA catheter is more than a rumor, why has this occurred and what are the implications for clinical care and training?

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REFERENCES

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