

THE PRINCIPLES OF CRITICAL CARE MEDICINE

Committee of Origin: Critical Care Medicine

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Introduction

The practice of anesthesiology has become increasingly complex. Not only are the clinical sites of care expanding, but the challenges of the clinical management have also increased. Advances in anesthetic management as well as improved understanding of perioperative needs of patients undergoing anesthesia and surgery have altered the environment in which the anesthesiologist practices. As a result of these changes, every anesthesiologist is expected to have the basic skills to manage the majority of medical emergencies occurring in the operating room, as well as provide cardio-respiratory resuscitation and emergency airway management in other settings. Most importantly, as a result of clinical demands on other specialists, the increasing surgical volume and an emphasis on patient safety, anesthesiologists are now expected to provide an increasing proportion of preoperative care and to serve as perioperative physicians in a number of settings. The skills, knowledge and expertise of anesthesiologists have historically made them the ideal intensivists, and they once again create opportunities for the anesthesiologist to serve as the critical care physician and, in some cases the “surgical hospitalist.”

Critical care has been a subspecialty of anesthesiology for some time, recognized by formal certification of special qualifications in critical care medicine by the American Board of Anesthesiology (ABA). In addition to acquiring general skills in the management of the ICU patient that is a part of the anesthesiology residency program, fellows in critical care medicine must acquire additional competencies relevant to the care of any critically ill patient. The American Society of Anesthesiologists (ASA) recognizes the importance of this specialty training and is committed to ensuring that patients have access to and receive these needed critical care medical services provided by appropriately trained and skilled practitioners.

This position paper describes trends in critical care medicine and defines the importance to the specialty of ensuring that critical care medicine remains a vital part of anesthesia practice. It specifically addresses the following issues:

- Reviews the services provided by critical care anesthesiologists (also known as intensivists)
- Describes the benefits of critical care medicine practice on patient outcome and resource utilization
- Redefines the importance of critical care medicine to the medical specialty of anesthesiology
- Describes some recent challenges to the practice of critical care medicine and approaches to address them

- Describes a strategy for ASA to adopt to ensure that critical care medicine remains a vibrant and integral part of the practice of anesthesiology

What Is Critical Care Medicine?

Some of the patient management activities performed by the anesthesiologist in the operating room are the same as the critical care services required in an intensive care unit (ICU) or during resuscitation. Anesthesiologists formally trained in critical care medicine provide additional intensive diagnostic and therapeutic interventions within the ICU or during resuscitation that directly affect patient management and outcome. The clinical services provided by critical care anesthesiologists are comparable to those services provided by intensivists who receive training and certification of qualifications through the specialty boards of Surgery and Internal Medicine. Although work environments range from medical and surgical ICUs to specialized intensive care units, such as neurologic intensive care units and trauma units, or other combinations as dictated by local requirements and resources, many of the services provided to critically ill patients are similar regardless of the underlying disease. While critical care anesthesiologists most often provide care to patients in surgical intensive care units, the diversity of their skills offer an opportunity to care for patients with both medical and surgical illnesses. Combining the unique skills of each specialty in a multidisciplinary intensivist group optimally provides critical care medicine services.

Specially trained critical care physicians offer a scope and intensity of services significantly different from, but complementary to, those provided by the operating surgeon or the primary care provider. Critically ill or injured patients require a broad range of specialized services and thus the expertise of a critical care specialist. These services are separate and distinct from the care rendered by the primary care provider or operating surgeon, and patients clearly benefit from this coordinated care.

Clinical presentation and the associated pathophysiology dictate the breadth and depth of critical care services patients require. A multidisciplinary approach, rendering a multiplicity of services, optimizes the clinical outcomes of this complex patient population, while simultaneously utilizing costly resources most effectively. Some of the services required of these specially trained clinicians include the following:

1. Institutional administrative and clinical leadership in the management of resuscitation from in-hospital cardiac arrest to post-resuscitative care, including organ failure support, prognostication for neurologic recovery, and therapeutics, such as therapeutic hypothermia.
2. Ventilator management, including titration of FiO_2 , application and adjustment of ventilator mode (invasive or noninvasive), interpretation of waveforms, respiratory patterns and use of innovative pulmonary support techniques to safely optimize gas exchange and limit ventilation-induced lung injury
3. Hemodynamic management, including proper placement technique and interpretation of data from routine monitors, diagnostic studies such as transesophageal echocardiography, and invasive hemodynamic monitoring such as that provided by central venous or

- pulmonary artery catheters as well as less invasive monitors
4. Administration and titration of inotropic agents and vasoactive drugs
 5. Fluid and electrolyte management to optimize end organ perfusion and avoid or manage complications of over- or under-hydration, including renal failure, congestive heart failure or pulmonary edema, impaired bowel or extremity perfusion
 6. Blood component administration to increase oxygen delivery and ensure adequate coagulation profile
 7. Management of myocardial dysfunction and arrhythmias, including use of drugs to reverse or limit myocardial insult and manage the entire spectrum of arrhythmias
 8. Pain management using appropriate pain inquiry and scoring complemented as needed by intravenous, intraspinal or epidural analgesics, intermittent or continuous peripheral nerve blocks and administration of adjuvant medications
 9. Neurological evaluation and management to optimize cerebral and spinal cord perfusion and minimize adverse neurologic outcome associated with electrolyte imbalance, hypoperfusion or increased intracranial pressure and achievement of targeted temperature
 10. Management and evaluation of metabolic abnormalities and/or endocrine emergencies such as diabetes mellitus, hyper- or hypothyroidism, adrenal insufficiency, diabetes insipidus, syndrome of inappropriate antidiuretic hormone release and cerebral salt wasting syndrome
 11. Emergent evaluation and airway management, including, but not limited to tracheal intubation, percutaneous tracheostomy, and bronchoscopic evaluation
 12. Appropriate diagnostic evaluation in patients with infectious diseases, including initiation of antimicrobial agents and assessment of therapeutic response
 13. Initiation and management of renal replacement therapy/dialytic support
 14. Management of patients with hepatic dysfunction or failure
 15. Initiation of anti-inflammatory therapies as indicated
 16. Appropriate use and monitoring of chemical and physical restraints
 17. Nutritional support, including enteral and parenteral nutritional management and monitoring of metabolic function
 18. Complex wound care, utilizing techniques to promote wound healing

19. Caring for the psychosocial needs of the critically ill patient and family
20. Ensuring that the ethical precepts of medicine, anesthesiology and intensive care medicine are adhered to
21. Provide holistic patient and family care along with expert opinion in ethics, end-of-life and palliative care for the critically ill
22. Provide institutional leadership for intensive care unit medical direction
23. Lead data management, outcomes evaluation and clinical research programs where applicable

What Is the Clinical Benefit of Critical Care?

Over the past several decades, numerous studies have documented the benefits to the care and outcome of acute and critically ill medical and surgical patients when critical care specialists direct or are integrally involved in patient care. Despite the wide spectrum of clinical problems for which a patient might require ICU care, studies have documented improved quality of care, reduced length of stay, improved resource utilization, reduced complications and improved morbidity and mortality. Studies performed in adult and pediatric intensive care units, in university and community settings, with and without resident involvement, in United States and Canadian facilities, and in single institutions and across entire states have all drawn the same conclusions. More recent data (Levy 2008), suggest the link between intensivist care and mortality is not always favorable. Careful analyses of these data suggest that it is not just the presence of an intensivist, but also that of a comprehensive type of multidisciplinary care and an established leadership presence (Rubenfeld and Angus 2008) that may be the important factors. As experts in coordinating care across specialties and providers, anesthesia intensivists are uniquely qualified to fill a leadership role on a multidisciplinary team.

In addition to the clinical benefit, the presence of a dedicated critical care physician helps reduce ICU length of stay and resource use. Studies by J.J. Brown, C.A. Manthous, A.S. Multz, C.W. Hanson, P.J. Pronovost and B.A. Rosenfeld each demonstrate reduced ICU length of stay. The benefit on length of stay persists through to hospital discharge in the studies that followed patients for that outcome variable. The critical care physician is also able to ensure more appropriate use of ICU beds. Four of the studies demonstrated reduced use of ICU resources for low-risk patients. The dedicated critical care physician is able to establish criteria for admission and identify alternative sites for the care of patients without compromising outcome, particularly for the patients who are at low risk of developing complications. Without the availability of the dedicated specialist, many patients who do not require or benefit from ICU care would be admitted and would needlessly utilize costly resources. They would also occupy a bed that might be more appropriately used to care for a patient in need of critical care services. As a result of effective triage, participation of the critical care specialist results in reduced patient charges and lower professional consultation fees. Much of this information is contained in the excellent systematic review, Pronovost PJ, Angus DC, Dorman T, Robinson KA, Dremsizov TT, Young TL. Do intensivists improve the outcome of critically ill patients? *JAMA*. 2002; Nov 6; 288(17):2151-2162.

Industry leaders have recently acknowledged the value of the dedicated critical care physician. A study completed by the Solucient Leadership Institute documents that standardization of ICU care by dedicated critical care specialists reduces costs and improves outcome. Fewer patients die or face complications when 1) critical care physicians are available on site; 2) patient care teams consisting of ICU nurses, respiratory therapists and pharmacists are directed by a critical care

physician; and 3) standard procedures are identified for ICU admission and treatment of specific clinical conditions.

Purchasers of health care recognize these advances and have acted to promote such care. The Leapfrog Group, an alliance of Fortune 500 companies and the Federal Employee Health Benefit Plan, was created to mobilize employee purchasing power seeking to initiate breakthrough improvements in the safety and overall value of health care to American consumers. The Group has developed three initiatives to improve patient safety. One of them recommends contracting only with hospitals staffed with dedicated ICU physicians who are certified (or eligible to be certified) in critical care medicine. To become part of Leapfrog, health care purchasers must agree to implement this initiative. On November 15, 2000, the National Press Club released these specifications, and final implementation occurred on December 31, 2003. Since then Leapfrog has seen approximately a 100-percent increase in Intensivist staffing. Unfortunately, almost 70 percent of critically ill adults still lack involvement of an Intensivist. Leapfrog will no longer create new specifications, but will endorse the patient safety goals crafted by National Quality Forum (NQF). The Intensivist staffing specification remains as a component of the expanded list of NQF goals. (Pronovost PJ, Needham DM, Waters H, Birkmeyer CM, Calinaw JR, Birkmeyer JD, Dorman T. Intensive care unit physician staffing: Financial modeling of Leapfrog standard. *Crit Care Med.* 2006; 34 (3 supp): S18-24).

What Does This Mean to the Practice of Anesthesiology?

The significance of these findings to the practice of anesthesiology is clear. First, an understanding of critical illness and some of the basic aspects of managing the critically ill patient must remain an integral part of the training of all anesthesiologists. The skills of the anesthesiologist are essential to fulfill many of the clinical needs of critically ill patients. Therefore every anesthesiologist must have training in critical care medicine. The training in critical care medicine should include experience in clinical management of critically ill patients with particular emphasis on emergency airway management techniques, cardio respiratory resuscitation (including ACLS), cardiopulmonary physiology, invasive and noninvasive monitoring techniques, respiratory care and mechanical ventilatory management, hepatic failure, renal failure, coagulopathy, sepsis syndrome and multisystem organ failure. While the primary emphasis during residency training may be on surgical critical care management, every resident should have sufficient experience in the management of other patient populations to understand their clinical needs and obtain the clinical skills necessary to participate in their care after completion of training. As the body of knowledge required to either provide anesthesiology services to critically ill patients or practice as an intensivist continues to increase the time anesthesiology residents are exposed to critical care medicine, periodic review and potential readjustment will be required.

Second, subspecialty fellowship training in critical care medicine should continue to be offered as part of the continuum of anesthesiology training. The critical care anesthesiologist offers significant clinical value to patients and administrative value to the department and institution, whether an academic enterprise or community hospital. The fellowship training should include broader clinical exposure to patients of all ages and to all aspects of critical care practice. To the extent possible, this training should include time spent in diverse intensive care units and should not be restricted to postoperative patient care. Fellows in Critical Care Medicine should gain experience in the care of patients with neurologic and cardiac diseases, trauma, burns, transplant and obstetric critical care.

The training should also include administrative experiences appropriate to the management of an ICU as well as training in medical ethics, end-of-life care and pain management.

The practice of critical care medicine dramatically elevates the professional profile and clinical reputation of anesthesiologists within any institution, and anesthesiologist-intensivist practitioners are frequently the only anesthesiologists with whom nonoperating room professional personnel have routine contact. As such, critical care medicine-trained anesthesiologists constitute an invaluable conduit of insight into perioperative medicine for their non-surgeon peers, as well as a vital conduit of feedback and follow-up to their O.R. counterparts.

Finally, we must ensure that critical care services are paid for adequately. The services provided by the dedicated critical care practitioner are essential to the care of patients and provide significant financial and management advantage to an institution. The services are different from the services provided by the surgeon as part of routine postoperative care or by the primary care provider. These services can be defined and clearly differentiated. Based on this differentiation, separate billing for critical care should be allowable and paid for using accepted codes for the specific critical care services. The ASA should continue to advocate for the regulatory flexibility necessary for critically ill patients to receive the care they require from appropriately trained intensivists.

What Does the Future Hold?

The aging population and the increasing trend to provide medical and surgical services to patients with higher acuity of illness and co-morbidity is already resulting in a higher demand for ICU care (The Critical Care Crisis in the United States A report from the Profession. Mark A. Kelley, M.D., FCCP; Derek Angus, M.D., MPH, FCCP; Donald B. Chalfin, M.D., MS; Edward D. Crandall, Ph.D., M.D., FCCP; David Ingbar, M.D., FCCP; Wanda Johanson, R.N., M.N.; Justine Medina, R.N., M.S.; Curtis N. Sessler, M.D., FCCP, and Jeffery S. Vender, M.D., FCCP. *Chest*. 2004;125:1514-1517, Vincent J-L, Singer M, Marini JJ, Moreno R, Levy M, Matthay MA, Pinsky M, Rhodes A, Ferguson ND, Evans T, Annane D, Hall JB. Thirty years of critical care medicine. *Critical Care*. 2010; 14:311), yet intensivists currently provide care to only 37 percent of all ICU patients in the United States, mostly in larger hospitals and teaching institutions. (Angus DC, Kelley MA, Schmitz RJ, et al. Current and projected workforce requirements for care of the critically ill and patients with pulmonary disease: Can we meet the requirements of an aging population *JAMA*. 2000; 284:2762-2700).

While “high-intensity intensivist staffing” has been shown to improve clinical outcomes and

efficiency, the mathematics of supply and demand highlight an obvious and dramatic imbalance in the near future and the risk that soon, even more critically ill patients may not have access to health professionals qualified to treat them. This trend is observed not only for physicians, but also for all other health care professionals, including nurses and pharmacy services. (Perspectives on the nursing shortage: blueprint for action. Monograph series 2000 American Organization of Nurse Executives. Washington, DC: Pharmacy Manpower Project. The pharmacist workforce: study of the supply and demand for pharmacists. Washington, DC: Department of Health and Human Services, Health Resources and Services Administration, Bureau of Health Professions, 2000).

Critical care medicine in general and critical care anesthesiology in particular face numerous challenges to the viability of the specialty. For anesthesiology, the role for the critical care anesthesiologist is potentially compromised not only by outside forces, but also by the specialty itself. Many anesthesiologists do not recognize the value critical care brings to a department and to the specialty. They do not see the advantages of practice opportunities outside of the operating room, except perhaps in the practice of pain management. In fact in both academic and community practices, critical care medicine has significant value, and models of care have been successfully developed to ensure the financial and political futures of a department. These successfully developed models must be made available to a wider range of anesthesia practices and expanded to other departments. Broadening the participation of the department in the care of critically ill patients provides more diverse practice opportunities for anesthesiologists to ensure continued professional and personal development.

Extending the services of an anesthesia practice in to critical care can strengthen the relationship of that practice with a hospital, potentially improving the value and stability of its contract. In a practice survey conducted in late 2010 through the Society of Critical Care Anesthesiologists (SOCCA) and the American Society of Anesthesiologists (ASA), 55% of practices reported providing critical care services. Of those not providing critical care services, 30% reported having been approached by their hospital about providing them. The reasons cited by those practices for not providing these services were largely related to manpower, financial payment and local political considerations. Most interesting, 25% of respondent practices reported being threatened with loss of contract in the last three years. Of note, only 7% of practices providing critical care medicine services were threatened, compared with 50% of practices not providing these services.

Another serious threat to the practice of critical care anesthesiology is the current shortage of anesthesiologists. As needs in the operating room become more difficult to fulfill, the desire to develop practice opportunities outside of the operating room diminishes. This pressure to populate the operating room with anesthesiologists should not undermine the future of critical care as a legitimate subspecialty of anesthesiology, but rather augment it. The majority of critical care anesthesiologists continue to spend most of their clinical time working in the operating room. The ICU represents only a fraction of their clinical commitment. As a result, the continued support for critical care training within anesthesiology residency and fellowship programs will actually attract more residents to the specialty and might broaden the pool of potential applicants. Rather than detracting from our primary mission, critical care medicine fosters our specialty goals.

Adequacy of payment remains an additional threat to the future of critical care medicine. Structure and ongoing changes in the Centers for Medicare & Medicaid Services' (CMS) Resource-Based Relative Value System potentially threaten professional payments to critical care specialists. The complexities associated with the fee updates, including “zero sum” payment calculus, offsetting adjustments in work values and conversion factors, and the effects of bundling of critical care services into some procedure codes, underscore the importance of ongoing advocacy efforts to secure reasonable payment. While the surgeon is responsible for postoperative management of the surgical patient, critical care services are and can easily be differentiated from routine postoperative care. The need to specifically differentiate these services and pay critical care providers for them is critical. Finally, by avoiding and eliminating

many complications, critical care providers can be forced to use lower payment codes; given

fixed capacity in most intensive care units this has the effect of reducing compensation for improved outcomes.

Conclusion

Critical care medicine continues to be an important and viable subspecialty of anesthesiology. Anesthesiology is the practice of medicine, and critical care represents an important aspect of our practice, ASA and anesthesiologists must continue to support the subspecialty as a legitimate and essential component of the specialty. By so doing, we ensure the future of the specialty as a whole, and we will continue to attract the best and brightest physicians into the practice of anesthesiology.

The current climate of projected ongoing shortages of intensivists combined with the movement to greater acute care services for an aging population with multiple chronic conditions will drive the need for increased multidisciplinary critical care services. Anesthesiologists have a long and proud heritage in critical care medicine and must continue to participate at the local, regional and national levels in providing state-of-the-art intensive care to patients of all ages and pathologies. In order to accomplish this, we must promote critical care medicine practice by our specialists, enhance intensive care training, maintain access and participation in the care of the entire spectrum of critically ill patients, and ensure that intensivists have the necessary tools and compensation to provide the best care while optimally using available resources and judiciously assessing outcomes.