

# The Anesthesiology/Emergency Medicine Combined Residency: Defining a New Future for Trauma Resuscitation

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**Abstract** As management of patients in extremis becomes increasingly complex, the need for a resuscitation consultant is apparent. This physician must be able to provide and/or coordinate care for the acutely ill and injured patient across the continuum of care; from presentation to definitive care to disposition. The resuscitation consultant produced by a residency in anesthesiology and emergency medicine will capitalize on the complementary strengths of both programs; a 60-month residency will offer board eligibility in both specialties. The first (PGY-1) year will be spent as an intern on the emergency medicine service and the second (PGY-2) year will be spent on the anesthesiology service as a clinical anesthesiology-1 resident. The remaining 3 years will be split into 18 months each of anesthesiology and emergency medicine. Approval of the program in anesthesiology and emergency medicine by appropriate governing bodies is a pre-requisite for program establishment. While medical students will determine the success of the program in anesthesiology and emergency medicine (for it is they who are the prospective applicants to the program), it is the patient who will be the

beneficiary of a uniquely trained resuscitation consultant. A physician who is at ease diagnosing undifferentiated disease, managing resuscitation in the operating room or interventional radiology suite and managing the critically ill patient throughout the care continuum will define the future specialty.

**Keywords** Trauma · Resuscitation · Residency · Simulation · Anesthesiology · Emergency medicine

## Introduction

The role that resuscitation plays in the care of the injured patient has become more apparent as the management of trauma matures in the context of lessons learned from the past decade of conflict in Iraq and Afghanistan. The prompt application of basic medical technologies like tourniquets have saved many lives on the modern battlefield, just as they did on battlefields of the past [1]. Refinements of trusted therapies like blood transfusion have improved outcomes, and rigorous investigations continue to define the margins for improvement in trauma resuscitation [2–4].

A perfect surgery performed on a poorly resuscitated patient is of no benefit. Similarly, aggressive resuscitation without equally effective surgery is also a failure. The role of the anesthesiologist in resuscitation defines the trauma anesthesiologist. Procedural fluency, while required for the anesthesiologist, should not limit the specialty to a purely technical role. Anesthesiology is no more defined by (or limited to) endotracheal intubation than the specialty of critical care is defined by ventilator management. Trauma Anesthesiology combines a thorough understanding of the pathophysiology of acute illness with the interplay of anesthetics during an on-going resuscitation; there is no

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currently available physician specialist training program that incorporates the appropriate elements to accomplish this goal.

The emergency physician understands the challenges inherent in the diagnosis of undifferentiated disease and the pathophysiology of the critically ill patient under physiologic stress (e.g., trauma, sepsis). The emergency physician's intervention as the first physician responder for many trauma patients is integral to the continuum of care for these patients; appropriate primary care defines the subsequent hospital course and outcome.

A combined residency in anesthesiology and emergency medicine can incorporate and supplement the strengths of these two specialties to manage patients along the continuum of resuscitative and definitive care. As medical practice continues to find more resources outside traditional medical constructs (e.g., mid-level providers, on-line resources), physician consultants must provide a "value added commodity." The resuscitation expert will consult on patients in the emergency department, manage their medical care in the OR/IR suite, and coordinate their ongoing management in the ICU. The future of physicians in hospital-based practices will be defined by their capacity to rescue, manage, and coordinate care across a wide spectrum of diseases and environments of care.

## Combined Programs

The concept of a combined anesthesiology and emergency medicine program is not without precedent. Both anesthesiology and emergency medicine offer programs of combined study with internal medicine. The objective of these programs is to develop physicians who integrate the similarities of specialties with significant didactic and clinical overlap while amplifying the unique contributions of each in the final curriculum. Physicians with combined training offer a sophisticated perspective on complex clinical problems (e.g., a patient with significant chronic medical issues who presents for a complex anesthetic, or a patient who presents repeatedly to the emergency department with multiple co-morbidities). These combined programs offer a template for an anesthesiology emergency/trauma medicine program; a description of the anesthesiology/internal medicine and internal medicine/emergency medicine programs bears consideration.

The combined anesthesiology/internal medicine residency, established in 2012, requires 5 year for completion [5•, 6•]. When taken as separate courses of study, the anesthesiology and internal medicine programs would require 6 years to complete. To be eligible for board certification in both fields, a resident must complete a 60-month combined program. This represents a 12-month

reduction in training time that is possible due to the overlap of curricula in each specialty. The American Board of Internal Medicine (ABIM) requirement of 36 months of training time is met by 30 months of training in internal medicine; and supplemented with 6 months of training appropriate to internal medicine accomplished during the anesthesiology curriculum. The American Board of Anesthesiology (ABA) requirement of 48 months of training is met by the first year of internal medicine internship combined with 30 months of training in anesthesiology, and supplemented by 6 months of anesthesiology-related experience in the internal medicine program.

The first year (PGY-1) is the internship in internal medicine. The second year (PGY-2) is devoted to 12 months of training in anesthesiology. In the remaining 3 years, residents must spend 6 months in each specialty per annum, typically divided into 3-month blocks.

Specific requirements throughout the 30-month internal medicine program include:

- 20 months of internal medicine inpatient and outpatient rotations, to include geriatrics (at least 1/3 of rotations must be inpatient and at least 1/3 of rotation must be outpatient)
- A 4-week experience in the emergency department during the PGY-1 year
- Four months of medical critical care, and 1 month of surgical critical care
- An ambulatory experience with a minimum of 130 half-day outpatient sessions

Specific requirement throughout the 30 months of anesthesiology training include:

- Two single-month rotations in obstetric, pediatric, neuro-, and cardiothoracic anesthesia
- One month of critical care during each of the last 3 years
- Three months of pain medicine, typically divided into chronic pain, acute pain, and regional anesthesia rotations
- One month in the pre-operative clinic
- Two weeks in the post-anesthesia care unit

Requirements for procedural proficiency must be met in both fields. In-training exams, continuing clinical (faculty on resident/resident of faculty/resident on program) assessments, and participation in regular conferences in both disciplines must be attended throughout the 60 months. Documentation of ACGME core competencies must be tracked throughout the training period.

In 1989, the American Boards of Internal Medicine and Emergency Medicine began to offer dual certification for candidates who had completed combined residency programs in internal medicine and emergency medicine [7•].

The program is 60 months in length, similar to the anesthesiology/IM combined program; with 30 months of training each devoted to internal medicine and emergency medicine.

Requirements specific to IM include:

- 20 of the 30 months in internal medicine must include direct management of patients within the domain of internal medicine
- Three months of critical care
- Seven months of non-intensive care inpatient rotations
- Four months of IM subspecialty experience
- Two months of ambulatory medicine
- A maximum of 3 months of emergency medicine
- A continuity experience in which residents attend a one-half day per week continuity care clinic
- Geriatric and general medical consultant service experience
- At least 1/3 of the 30 months must involve outpatient rotations
- “Significant exposure” to cardiology, psychiatry, and neurology

Requirements specific to EM include:

- 3 % of the patient population must present with critical illness
- Pediatric patients should account for 16 % of all emergency department encounters; or 4 months of full time experience caring for infants and children, of which 2 months must be in the emergency department.
- Two months of critical care from the IM program may be credited to the EM curriculum
- Clinical experience in emergency medical services and trauma management

## Competency

Ultimately, any curriculum must develop physicians with documented competency in the care of acutely ill and injured patients. Competency, however, is often difficult to define. The Accreditation Council for Graduate Medical Education (ACGME) has defined competency in six areas; knowledge, patient care, professionalism, communication & interpersonal skills, practice-based learning & improvement, and system-based practice. Their focus is on development of clinical competency rather than a system based primarily on time in training.

Recently the Accreditation Council for Graduate Medical Education and the American Board of Anesthesiology introduced a joint initiative entitled the “Anesthesiology Milestone Project” [8•]. The Milestone Project provides a template for semi-annual review of resident performance

along a spectrum of identified benchmarks. While not intended to be assess the entirety of the six domains of physician competency, the Milestones provide a framework in which to assess development of resident knowledge, skills, attitudes and other attributes from program entry to graduation. Five distinct levels evaluate trainees from post-graduate year 1 (level 1) to a few exceptional residents who exceed expectations of new residency graduates (level 5).

In a similar effort to quantify competency, Miller’s model of competence describes several levels of understanding (i.e., knows, knows how, shows how, does) [9]. At the basic level, one “knows” the material at the knowledge level. One “knows how” a process works at the next higher level, followed by one who meets expectations and “shows how” to perform a task. Finally, a trainee acts independently (i.e., the “does” level). Competency has also been described as a continuum from unconscious-incompetence to unconscious-competence. The unconsciously incompetent physician “doesn’t know what they don’t know”; they are dangerous. A consciously incompetent physician is aware of their limitations, but is not able to perform without supervision (e.g., junior residents). A consciously competent physician is safe and capable (e.g., senior trainee or program graduate). Unconscious-competence defines mastery of the specialty. Rarely, senior physicians will achieve this distinction. Unfortunately, the unconsciously incompetent individual is difficult to distinguish from those who are unconsciously competent, drawing attention to the need to evaluate competency.

## Learning Styles

Individual learning styles are an important consideration in competency determination. Fleming’s VAK/VARK model divides learning into visual, auditory, reading, and kinesthetic/tactile styles [10]. Visual learners conceptualize ideas visually and use cognitive aids. Auditory learners use speech and hearing to place concepts within a familiar construct. They may prefer background music while studying and sometimes like to “talk out a problem.” They tend to benefit from podcasts, lectures, and other auditory formats. Reading learners prefer to assimilate information from a well-referenced text. Tactile learners, or kinesthetic learners, use touch and movement to assimilate concepts; and benefit from active experimentation. Ultimately, learners have some component of all learning styles and may benefit from a multi-disciplinary approach.

As noted above, defining competence in medical practice is an elusive goal, and different learning styles have not been prospectively associated with performance [11, 12]

## Evaluation of Learning

The fundamental knowledge base of any specialty is provided by comprehension of basic concepts in that subject. Standardized testing with multiple choice questions screens for a basic level of understanding. While these exam formats can efficiently evaluate large numbers at a fundamental level, there are significant limitations to their ability to demonstrate mastery of subject matter.

An American medical school's first 2 year curriculum was evaluated using Moore's expanded outcomes framework [13]. Questions were categorized as those requiring rote memorization (level 3A), questions requiring application of knowledge (level 3B), and questions evaluating competence by requiring "[showing] how to do what the educational activity intended them to be able to do" (level 4). The authors noted that some level 3A questions could even be answered without reading the entire question.

The first year of medical school focuses on acquisition of facts, with nearly 90 % of exams testing what is essentially recall. Procedural (application) questions accounted for 14 % of exam content. The second year of medical school did demonstrate an increase in procedural questions, with nearly 90 % of exams evaluating knowledge application. No exams contained competence level questions. Allied health education offers a similar educational style [14].

Acquisition of a knowledge base set is an undeniable component of education; however, these evaluation formats are often focused on recall. Competence in tactile procedures (e.g., endotracheal intubation, suturing, bronchoscopy), mastery of concepts (e.g., pathophysiology, pharmacology), and analytical synthesis (e.g., development of treatment plans) are all part of medical education.

## Simulation

In simulation, idealized scenarios are presented in which potentially dangerous situations are evaluated. Creation of a training team environment, without risking the safety of actual patients, offers one of the great advantages of simulation. Leadership styles can be critiqued and communication can be improved.

Abrahamson introduced computerized evaluation of anesthesiology resident's ability to intubate in the 1960s. Gaba subsequently recreated the training environment with more advanced anesthesia simulators [15]. A tactile operating room simulation experience was created in a 'safe' (off site) environment utilizing appropriate equipment and actors and/or other trainees from relevant disciplines schooled with appropriate 'scripts' necessary to complete

the simulated experience. Simulation sessions were conducted using the pre-designed scripts (unknown to the test subject) and directed by simulation staff. Test subjects participated in scenarios and feedback questionnaires were evaluated. Simulation was identified as a realistic training tool for potentially risky procedures.

While simulation can improve communication and adherence to protocols, there has been little data to demonstrate improvement in outcome [16]. Nevertheless, simulation has been incorporated in graduate medical education, and even board certification. Ziv described the use of simulation in an Objective Structures Clinical Examination (OSCE), in anesthesiology board certification [17]. Ziv concludes; "there is no doubt that incorporating simulation and OSCE for testing and evaluation should play a formative (training) and a summative (testing) role, involving the anesthesiology board."

Simulation offers the opportunity to practice procedures before attempting them on a patient, and the ability to simulate emergencies like cardiovascular collapse or malignant hyperthermia. Facilitator monitored video replay analysis offers further valuable feedback. While simulation offers a valuable lesson in reinforcing procedural skills necessary for medical practice, the evaluator must appreciate the limitations of simulation.

## The Program in Anesthesiology and Emergency Medicine

Qualification in anesthesiology has undergone significant change recently. Anesthesiology board certification currently involves a basic sciences examination at the conclusion of the introductory anesthesia year, followed by a clinical sciences examination at the completion of the program. A combined oral exam and procedural skills demonstration, similar to well-known simulation sessions, will replace the traditional oral exam with no procedural component. The emergency medicine board certification process also involves written and oral exam formats. This evaluative system will capitalize upon a range of educational platforms (e.g., lectures, clinical rotations, individual study). As specialties across the practice of medicine debate the ideal method to train for and to maintain proficiency in an increasingly complex medical landscape, educational constructs that share similarities across specialties can be leveraged to refine resident education and board preparation.

The combined residency in anesthesiology and emergency medicine will be patterned after other combined programs; and will capitalize on similarities in both programs. A 60-month residency will offer board eligibility in

**Table 1** The program in anesthesiology and emergency medicine

PGY-1	PGY-2	PGY-3	PGY-4	PGY-5
Emergency medicine	Anesthesiology	2 months CCM	1 month CCM	1 month Anes cardiothoracic
PGY-1 internship	CA-1 general OR	2 months Anes Peds	2 months Peds EM	1 month Anes Neuro
		2 months EM Peds	1 month Anes OB	1 month Anes pain
		1 month Anes OB	1 month Anes cardiothoracic	2 months Anes general OR
		1 month EM OB	1 month Anes Neuro	4 months EM acute care ED
		2 months Anes general OR	2 months Anes Pain	2 months EM non-acute ED
		2 months EM non-acute ED	1 month Anes pre-op clinic	2 weeks EMS + 2 weeks Anes PACU
			1 month EM non-acute ED	
			2 months EM acute care ED	

PGY post-graduate year, CA clinical anesthesia, CCM critical care medicine, Anes anesthesiology, Peds pediatrics, EM emergency medicine, OB obstetrics, OR operating room, ED emergency department, Neuro neurosurgery, EMS emergency medical services

both specialties. The first (PGY-1) year will be spent as an intern on the emergency medicine service. The second (PGY-2) year will be spent on the anesthesiology service as a clinical anesthesiology-1 (CA-1) resident. Initial introduction to both specialties with a year of uninterrupted study will immerse the resident in the clinical approach to undifferentiated disease (i.e., emergency medicine) as well as to the management of the perioperative patient (i.e., anesthesiology).

While appreciation for the pathophysiology of disease is the foundation of all physician education, the curricula in anesthesiology and emergency medicine also emphasize mastery of procedures (e.g., endotracheal intubation, placement of vascular access). Procedures specific to anesthesiology (e.g., transoesophageal echocardiography, epidural placement) and emergency medicine (e.g., transthoracic echocardiography, fracture reduction) can be learned in the periods of instruction specific to those specialties. Rotations in critical care will benefit both specialties and serve to consolidate several months of training time.

The remaining 3 years will be split into 18 months of anesthesiology and emergency medicine each (Table 1). This will accommodate the required rotations in anesthesiology (i.e., 2 months of obstetric, pediatric, neuro-, and cardiothoracic anesthesia, 3 months of pain medicine, 1 month in the pre-operative clinic, and 2 weeks in the post-anesthesia care unit); as well as emergency medicine (i.e., 4 months of pediatrics, 2 weeks of obstetrics, a clinical experience in emergency medical services and trauma management, and a broad clinical experience in the emergency department).

Specific education in trauma anesthesiology has recently drawn attention, due in part to the American College of Surgeons requirement that Level 1 Trauma Centers designate directors of trauma anesthesiology. A growing body of literature has emphasized the role of the anesthesiologist as

resuscitation consultant, and a curriculum for trauma anesthesiology has been suggested by the Committee for Trauma and Emergency Preparedness (COTEP) of the American Society of Anesthesiologists [18, 19].

The similarity in clinical approach and procedural skill sets of anesthesiology and emergency medicine has been noted during the past decade of conflict. Anesthesiologists and emergency physicians have provided forward resuscitative care aboard military evacuation platforms such as American Critical Care Air Transport and British Medical Emergency Response Teams [20•]. The complementary training of these specialties in the acute care of hemodynamically unstable patients offers an opportunity to consolidate educational objectives in order to develop a physician uniquely qualified to care for the patient while in extremis and throughout the care continuum. The combined program in anesthesiology and emergency medicine provides a mechanism for formalized training of these unique physicians.

## Conclusion

The resuscitation consultant produced by a residency in anesthesiology and emergency medicine will be able to care for the acutely ill and injured patient across the continuum of care; from presentation, during definitive care through disposition. This new type of physician must be comfortable filling an important, yet somewhat standardized, role during critical times in a patient's hospitalization. This may seem to be at odds with the more traditional, individualized role of "physician as artisan"; however, it is a realistic acknowledgment of the changing healthcare environment.

Appropriate oversight and approval by the ACGME and Residency Review Committees (RRC) for Anesthesiology and Emergency Medicine are pre-requisites for program



establishment. Ultimately, it is medical students who will determine the success of the program in anesthesiology and emergency medicine, for it is they who are the prospective applicants to the program. Finally and most importantly, it is the patient who will be the beneficiary of a uniquely trained resuscitation consultant who is at ease diagnosing undifferentiated disease, managing resuscitation in the operating room or interventional radiology suite and moving along the continuum of care with the critically ill and injured patients.

### Compliance with Ethics Guidelines

**Conflict of Interest** Joshua M. Tobin and Philip D. Lumb declare that they have no conflict of interest.

**Human and Animal Rights and Informed Consent** This article does not contain any studies with human or animal subjects performed by any of the authors.

## References

Papers of particular interest, published recently, have been highlighted as:

- Of importance
- Of major importance

1. Butler FK Jr, Hagmann J, Butler EG. Tactical combat casualty care in special operations. *Mil Med.* 1996;161(Suppl):3–16.
2. Holcomb JB, Tilley BC, Baraniuk S, Fox EE, Wade CE, Podbielski JM, et al. Transfusion of plasma, platelets, and red blood cells in a 1:1:1 vs a 1:1:2 ratio and mortality in patients with severe trauma: the PROPPR randomized clinical trial. *JAMA.* 2015;313(5):471–82. doi:10.1001/jama.2015.12.
3. Borgman MA, Spinella PC, Perkins JG, Grathwohl KW, Repine T, Beekley AC, et al. The ratio of blood products transfused affects mortality in patients receiving massive transfusions at a combat support hospital. *J Trauma.* 2007;63(4):805–13. doi:10.1097/TA.0b013e3181271ba3.
4. Holcomb JB, Wade CE, Michalek JE, Chisholm GB, Zarzabal LA, Schreiber MA, et al. Increased plasma and platelet to red blood cell ratios improves outcome in 466 massively transfused civilian trauma patients. *Ann Surg.* 2008;248(3):447–58. doi:10.1097/SLA.0b013e318185a9ad.
5. • American Board of Anesthesiology. Guidelines for combined training in internal medicine and anesthesiology. In: Combined training. 2015. <http://www.theaba.org/PDFs/Internal-Medicine/CombinedTrainingRequirementsInternalMed>. Accessed 15 Apr 2015. *Defines specifications for combined program in anesthesiology and internal medicine.*
6. • Accreditation Council for Graduate Medical Education. ACGME program requirements for graduate medical education in anesthesiology. 2014. [http://www.acgme.org/acgmeweb/portals/0/pfassets/programrequirements/040\\_anesthesiology\\_07012014.pdf](http://www.acgme.org/acgmeweb/portals/0/pfassets/programrequirements/040_anesthesiology_07012014.pdf). Accessed 3 May 2015. *Defines specifications for combined program in anesthesiology and internal medicine.*
7. • American Board of Internal Medicine. Internal Medicine/ Emergency Medicine Policies. In: Combined training in internal medicine. 2015. <http://www.abim.org/certification/policies/combinedim/comem.aspx-guidelines>. Accessed 15 Apr 2015. *Defines specifications for combined program in internal medicine and emergency medicine.*
8. •• Culley DCN, Hall S, Kuhn C, Lewis L, Mason L, Nestler SP, Patel RM, Scharlet S, Waldschmidt B, Warner M. The anesthesiology milestone project. In: Accreditation council for graduate medical education and american board of anesthesiology. 2013. <http://acgme.org/acgmeweb/Portals/0/PDFs/Milestones/AnesthesiologyMilestones.pdf>. Accessed 4 May 2015. *Describes innovative method to assess resident performance along continuum of learning from program entry to graduation.*
9. Miller GE. The assessment of clinical skills/competence/performance. *Acad Med.* 1990;65(9 Suppl):S63–7.
10. Fleming ND, Mills C. Not another inventory, rather a catalyst for reflection. *Improve Acad.* 1992;11:137–55.
11. Pashler HMM, Rohrer D, Bjork R. Learning styles: concepts and evidence. *Psychol Sci Public Interest.* 2009;9(3):105–19.
12. Rohrer D, Pashler H. Learning styles: where's the evidence? *Med Educ.* 2012;46(7):634–5. doi:10.1111/j.1365-2923.2012.04273.x.
13. Vanderbilt AA, Feldman M, Wood IK. Assessment in undergraduate medical education: a review of course exams. *Med Educ Online.* 2013;18:1–5. doi:10.3402/meo.v18i0.20438.
14. Masters JC, Hulsmeyer BS, Pike ME, Leichy K, Miller MT, Verst AL. Assessment of multiple-choice questions in selected test banks accompanying text books used in nursing education. *J Nurs Educ.* 2001;40(1):25–32.
15. Gaba DM, DeAnda A. A comprehensive anesthesia simulation environment: re-creating the operating room for research and training. *Anesthesiology.* 1988;69(3):387–94.
16. Okuda Y, Bryson EO, DeMaria S Jr, Jacobson L, Quinones J, Shen B, et al. The utility of simulation in medical education: what is the evidence? *Mt Sinai J Med.* 2009;76(4):330–43. doi:10.1002/msj.20127.
17. Ziv A, Rubin O, Sidi A, Berkenstadt H. Credentialing and certifying with simulation. *Anesthesiol Clin.* 2007;25(2):261–9. doi:10.1016/j.anclin.2007.03.002.
18. Committee for Trauma and Emergency Preparedness (COTEP). Curriculum for CA-1 and CA-2 residents. 2013. <http://www.asahq.org/For-Members/About-ASA/ASA-Committees/Committee-on-Trauma-and-Emergency-Preparedness.aspx>. Accessed 19 July 2013.
19. Committee for Trauma and Emergency Preparedness (COTEP). Curriculum for CA-3 residents. 2013. <http://www.asahq.org/For-Members/About-ASA/ASA-Committees/Committee-on-Trauma-and-Emergency-Preparedness.aspx>. Accessed 19 July 2013.
20. •• Kehoe A, Jones A, Marcus S, Nordmann G, Pope C, Reavley P, et al. Current controversies in military pre-hospital critical care. *J R Army Med Corps.* 2011;157(3 Suppl 1):S305–9. *Describes complimentary roles of anesthesiology and emergency medicine physicians in the combat environment.*