

FELLOWSHIP IN ANESTHESIA-CRITICAL CARE MEDICINE

at the
BRIGHAM AND WOMEN'S HOSPITAL
DEPARTMENT OF ANESTHESIOLOGY, PERIOPERATIVE AND PAIN MEDICINE

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History

July 2002 marked the beginning of the first independent fellowship in Critical Care Medicine in Department of Anesthesiology, Perioperative and Pain Medicine at the Brigham and Women's Hospital (BWH). Historically, this emerged from a previous joint fellowship with the Massachusetts General Hospital (MGH), inspired by the realization that in a one-year fellowship, trainees would benefit by focusing their time within a single institution. Benefiting from our unique interdisciplinary faculty model, we have developed a fellowship designed to allow trainees to develop advanced proficiency in the management of all aspects of the care of critically ill patients and to develop the skills necessary to supervise critical care units. The one-year fellowship in Critical Care focuses on direct patient care. The fellow spends a minimum of nine months in the care of ICU patients while supervising residents and medical students under the direction of the Critical Care attending staff.

Clinical Rotation Schedule

The Fellowship structure is composed of two week rotations, thirteen of which are spent in the core units of the 7C General SICU, the 7D Burn/Trauma SICU and the 11C Thoracic ICU. The remaining thirteen two-week blocks are divided among mandatory rotations, elective rotations and vacation. Mandatory rotations consist of the Cardiac Surgical ICU at BWH, the Medical ICU at BWH, the Neuro ICU at MGH, and pediatric ICU at The Children's Hospital. Additional elective time is available on services caring for critically ill patients such as the Coronary Care Unit, and the cardiology, electrophysiology, renal, infectious disease, and transplant consult services. The exact order of the rotations is established by the Program Director and the Fellow.

Core Curriculum

The Core Curriculum of the Fellowship, as outlined below, covers all the major aspects of the art and science of critical care, as outlined in “Requirements for Training in Anesthesiology Critical Care Medicine”:

- Cardiopulmonary resuscitation: ACLS and ATLS provider certification, responsible for leadership at all resuscitations taking place in the core ICUs
- Respiratory: airway management; respiratory failure - ARDS; pneumonitis; use of inhaled nitric oxide; ventilator management - ventilator modes; ventilator weaning; respiratory mechanics and work of breathing; barotrauma; care of postoperative thoracic patients, including special considerations for extrapleural pneumonectomy, lung transplantation, bronchoplastic and lung volume reduction surgery.
- Cardiovascular: rhythm analysis; therapy of dysrhythmias; pacing and pacers; hemodynamic monitoring; biomechanics of hemodynamic pressure monitors; analysis of hemodynamic data; myocardial dysfunction; myocardial ischemia; valvular diseases; pericardial tamponade; pericarditis; pulmonary hypertension and RV failure; use of vasopressors; shock - etiology, pathophysiology, and treatment; mesenteric vascular disorders; peripheral vascular disease; DVT and PE.
- Renal/GU: renal physiology and dysfunction; renal failure - chronic and acute; peritoneal dialysis; intermittent and continuous hemodialysis and ultrafiltration.
- Gastrointestinal: GI bleeding; liver dysfunction and failure; pancreatitis; management of stomas; ascites; intraabdominal sepsis.

Mission...

To provide cutting-edge, evidence-based care to critically ill patients, to advance knowledge through biomedical research, and to educate future practitioners, researchers and leaders in critical care.

- Hematologic: anemias, thrombocytopenia, management of neutropenic patients, DIC, coagulopathies, hypercoagulable states.
- Metabolic: acid-base disorders; electrolyte disorders; calcium, magnesium, and phosphorous disorders.
- Endocrine: management of diabetes in ICU patients; thyroid disorders; pituitary and adrenal dysfunction; parathyroid dysfunction.
- Infectious diseases: culture and isolation techniques and interpretation; nosocomial and catheter-related infections; antibiotic resistance, dosing, and drug interactions.
- Neurologic: Treatment of acute head injury; measurement and management of cerebral blood flow and intracranial pressure; subarachnoid hemorrhage; acute stroke, acute spinal syndromes; perioperative management of myasthenia gravis and other neurologic diseases.

Clinical Care Responsibilities

The Anesthesia Critical Care Fellow supervises the ICU residents in the care of all ICU patients, and is in turn supervised by ICU Attendings. During each ICU rotation, they round with the surgical teams and consultants on their ICU patients in the morning and then conduct morning ICU work/teaching rounds together with the staff physician. There is a daily lecture given by ICU staff to the residents, fellows and medical student clerks on subjects of current importance. The balance of the fellows' work day is spent providing care to the patients in the Unit, supervising all procedures, meeting with primary physicians, resident teams and consultants, and doing their own reading and research. The fellow takes call from home at night, supervising the care by the ICU resident who spends the night in the unit, and returns to the hospital for any issues that require his/her physical presence. During some weeks, there may be two fellows assigned to a given ICU so that overnight home call is shared on an alternating basis during the week. The fellow is on duty for an ICU an average of one out of every four weekends.

Interactions with the Critical Care Staff and Residents

The Critical Care Fellows direct all the activities in the ICUs under the supervision of the ICU Attendings; they supervise and teach the ICU residents and medical students, provide consultation and advice on critical care matters to the surgical residents and coordinate all plans with the surgical teams, surgical staff and consultants. Their non-patient care activities -- presentations, research, etc. -- are likewise done in association with Critical Care staff.

Responsibilities of residents in the critical care units

In the ICUs, residents are physically present on a 24-hour basis and provide care to all patients on a minute-to-minute basis. The three ICU resident teams are composed of three residents each, from the departments of anesthesiology (5), surgery (3), and emergency medicine (1). In addition, there is often a CA-3 anesthesiology resident doing an elective month. While admitting attending surgeon remains the physician of record during his/her patient's stay in the intensive care unit, the day-to-day critical care management is directed by the SICU attending and carried out by the SICU team. Major decisions are made collaboratively between the ICU team and the relevant surgical service, but orders in the core ICUs are written only by members of the ICU team. Ongoing communication is maintained between the critical care fellow and the surgical chief, and as changes in a patient's condition warrant changes in therapy, the surgical team is kept aware and involved via this mechanism as well. In emergencies, changes in therapy may need to be instituted before the primary team can be contacted.

The Clinical Spectrum

The fellows take care of the entire spectrum of critical care patients, working in multiple ICU's with a wealth of clinical disease and derangement. Over the course of the year they will encounter most, if not all, of the most important varieties of critical illness. Specialized areas of interest within the curriculum include:

- Cardio-respiratory resuscitation: Early in the fellowship year, each critical care Fellow completes ACLS and ATLS provider courses. Instructor certification is available to interested fellows. The fellows are expected to run all acute resuscitations that occur while they are in the hospital. In addition, they may be asked to evaluate floor patients in whom the perceived risk of needing acute resuscitation is high.
- Respiratory: BWH is one of the largest thoracic surgical center in the United States, a world-class referral site for the most complex thoracic surgical procedures. Bedside flexible bronchoscopy is a commonly performed procedure in the ICUs and the fellow has ample opportunity to become facile with this procedure. A full spectrum of respiratory disease is seen among the three core ICUs.
- Trauma, thermal, electrical and radiation injury: BWH is a verified Level I Trauma Centers, and annually admits over 1000 major trauma patients, respectively. All major trauma patients requiring ICU care are admitted to the Burn/Trauma Unit(7D). In addition, the BWH treats a number of seriously burned patients who are also cared for on 7D.
- Neurological: Patients with neurologic complications, neurologic trauma, or having undergone complex neurosurgery are frequently cared for in the 7C and 7D SICUs. An additional experience without call responsibility at the MGH Neurosurgical Intensive Care Units is a mandatory part of the curriculum, where additional topics and patient issues are discussed in a weekly Neuro-Critical Care conference.

The Brigham and Women's Hospital Anesthesia-Critical Care Medicine program takes advantage of the wide spectrum of patients and expertise available at a major teaching hospital at Harvard Medical School.

- Infectious diseases: A year-long series of monthly lectures in surgical infectious disease is provided by an Infectious Disease specialist. Areas of interest include classification of infections and application of isolation techniques, pharmacokinetics, drug interactions, management of antibiotic therapy during organ failure, and nosocomial infections. The fellows, in conjunction with the residents, routinely manage antibiotic therapy in the ICU patients, paying careful attention to all the above issues. Infectious disease consultation is obtained for difficult cases. Patient cases and additional issues are discussed in a biweekly infectious disease case conference.
- Pharmacokinetics and dynamics of drug metabolism and excretion in critical illness: A representative of the BWH Pharmacy department regularly attends rounds in the SICUs to provide continuous and timely expert assistance on these matters. These subjects are addressed in nearly every patient.
- Ethical and legal aspects of critical care: The fellows, being the nexus of communication in the ICU's, are intimately involved in all the ethical and legal issues that so commonly arise. There are biweekly ethics conferences that are designed to discuss specific ethical issues that have recently arisen in the ICUs, as well as to explore the role of the intensivist in addressing ethical and moral conflicts.
- Renal: The pathogenesis and course of acute renal failure, a common and serious complication of critical illness, evaluation of renal function, peritoneal dialysis and hemofiltration, and knowledge of the indications and complications of

hemodialysis. The fellows have ample opportunity to learn about renal dysfunction and dialysis in the ICUs. The Renal services are very aggressive, and bedside dialysis, CVVHF and CVVHD are commonly employed.

- Gastrointestinal: utilization of gastrointestinal intubation and endoscopic techniques in the management of the critically ill patient, application of enteral feedings, and management of stomas, fistulas and percutaneous catheter devices.
- Nutritional: application of parenteral and enteral nutrition, and the monitoring and assessment of metabolism and nutrition. Nutritional requirements are addressed daily in every ICU patient, and consultation with the Nutrition Support services personnel is obtained whenever nutritional therapy is used. The nutrition support consultants, as with all consultants in our ICUs, are very helpful in teaching and making recommendations. A biweekly nutrition conference addresses didactic and specific patient issues.
- Hematologic and coagulation disorders: Massive transfusion, coagulopathy and hypercoagulable states are seen with frequency, due to the number of trauma patients and the high volume of patient flow through the units. Blood Bank personnel and hematologists are readily available for consultation when needed.
- Critical obstetric and gynecologic disorders: BWH is a world-class maternal-fetal medicine center that performs 10,000 deliveries annually. Critically ill gynecologic and obstetric patients are admitted to the intensive care units as necessary.
- Monitoring and medical instrumentation: All patients in the ICUs are monitored, most having indwelling arterial lines, and at any one time approximately 70% have central lines. In addition, the didactic component of the curriculum covers the underlying biophysics and bioengineering principles, taught by bioengineering experts.

- Critical pediatric surgical conditions: Rotation in the Pediatric ICU is mandatory and is available in the Neonatal ICU.
- Principles and techniques of administration and management: As the “nexus” of the ICU’s, the fellows are intimately involved in making administrative decisions daily. They have the opportunity to work closely with different ICU Attendings and experience varying styles of management within common evidence-based practice principles.
- Biostatistics and experimental design: In-depth analysis of one or two key studies in the current literature is done on a monthly basis at the ICU fellow’s Journal Club. Statistical consultation and teaching is readily available within the institution through the Center for Clinical Research.
- Quality assessment and continuous improvement: Fellows ensure the timely reporting of complications and adverse events in the SICUs. They participate actively in the review and analysis of sentinel events and contribute to systematic solutions to identified dangers to patient safety.

Participation in Conferences

There is a daily didactic lecture delivered to the residents, largely by the on-duty SICU faculty. Part of the fellows’ education consists of undergoing the process of preparing and delivering didactic lectures, so that over the course of the year, each fellow presents five of these lectures to the residents. These are done on topics of interest to the fellow and include research-level physiology and pathophysiology, and examination and discussion of current clinical studies in critical care medicine, including studies being performed in our ICU’s. Once prepared, these talks should be suitable for presentation in other institutions or to different critical care audiences within the institution. The fellows are also responsible for presenting cases at the joint MICU/SICU case conference, and often present cases and discussions at monthly SICU M&M rounds.

Teaching responsibilities

One of the primary roles of the critical care fellows is teaching the residents and medical students. This is done primarily by supervising them during the course of caring for critically ill patients. Fellows are expected to teach both by example and by familiarizing the residents with the literature relevant to the patients for whom they are caring. Fellows are responsible for supervising and guiding all of the invasive procedures performed by residents.

The strength of the BWH Anesthesiology Critical Care Medicine Fellowship lies in the diversity and talent of its faculty.

Research and Education

Basic and clinical research is an important ongoing activity and a prime mission of the BWH. The anesthesia critical care fellowship provides the fellows with opportunities for participation in both clinical and basic science research.

Research in our ICUs is organized around the BWH Surgical ICU Translational Research Center (STAR) headed by Gyorgy Frenzl, MD, PhD. One research project manager, one nurse, and two research assistants participate in assisting with the clinical studies in the STAR Center. One full time research fellow each year (as a second year critical care fellow) has performed mentored clinical research as part of the STAR Center for two years now. STAR Center affiliated members include: a biostatistician, members of clinical research

groups from both the Renal and Infectious Disease division, as well as basic science researchers focusing on sepsis, inflammatory mediator, muscle physiology, and ischemia-reperfusion research. Members of the STAR Center do participate in large industry-sponsored drug trials, however this comprises the minority of the center's activity. These studies provide our fellows with insight into large clinical trials as well as with education on the mechanics of large-scale clinical trials.

The STAR Center works in close collaborations with the BWH Center for Surgery and Public Health (CSPH; a joint research center of the BWH Department of Surgery and the Harvard School of Public Health). Resources at STAR and CSPH are utilized by members of both. Additionally, many members of STAR Center and the Department of Anesthesiology, Perioperative and Pain Medicine hold positions at the CSPH.

STAR clinical and translational research is being conducted in the following overall areas:

1. Quality of care measurement and improvement
2. Retrospective analysis of critical care outcome variables
3. Prospective studies for testing predictive scoring systems, outcome variables, as well as intervention strategies

Current clinical research is focused on the following disease groups/areas:

1. Hemorrhagic shock
2. Trauma related outcomes
3. The role of heat-shock proteins in trauma and trauma outcomes
4. Management of coagulopathies related to trauma and hemorrhagic shock
5. Delirium in critically ill patients
6. Sepsis
7. Nosocomial (bacterial and fungal) infections
8. Early biomarkers of trauma, sepsis, and surgical intervention related organ damage

9. Effect of work hours on physician performance and the learning of trainees
10. The role of conflict resolution strategies in the improvement of critical care outcomes and systematic enforcement of standards of care
11. The effect of standard policies on care improvement in multidisciplinary, open critical care units

Staff and fellows participate in bi-weekly journal clubs as well as at the monthly research meetings where proposed, active, and completed projects are presented and discussed.

Evaluation

Specific issues regarding performance of the units and personnel are addressed at a monthly meeting of the ICU fellows and staff. Additionally, fellows are evaluated in written format by the faculty every three months exceeding board requirements. In accordance with the ACGME Outcome Project, a fellows performance is measured in the context of the six Core Competencies which are composed of patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism, and systems-based practice.

Selection of Fellows

Selection to the fellowship is highly competitive. Applications are available from the office of the fellowship director and should be submitted twelve to eighteen months prior to the planned starting date. Selected applicants are invited for interviews in Boston. Successful applicants may begin their fellowship at various times throughout the year; starting dates are negotiable.

Faculty

One of the great strengths of the BWH Anesthesiology Critical Care Medicine Fellowship lies in the diversity and talent of its faculty. Fourteen different attendings with formal training in critical care staff the SICUs, with members from anesthesiology, surgery, internal medicine, pulmonary medicine and emergency medicine. They are listed below, with their primary training backgrounds.

**Nicholas Sadovnikoff, MD, Fellowship Director,
Co-Director SICUs
Internal Medicine and Anesthesiology**

**Selwyn Rogers, MD, Director SICUs
Surgery**

**Gyorgy Frenzl, MD, PhD, Director of SICU Research
Anesthesiology**

**Shannon McKenna, MD, Director of Thoracic Surgical ICU
Anesthesiology**

**Thomas Edrich, MD
Anesthesiology**

**Peter Hou, MD
Emergency Medicine**

**Edward Ingenito, MD
Pulmonary Medicine**

**Edward Kelly, MD
Surgery**

**Barry Kitch, MD
Pulmonary Medicine**

**Vihav Patel, MD
Surgery**

**John Reilly, MD
Pulmonary Medicine**

**David Silver, MD
Anesthesiology**

**James Watkins, MD
Surgery**

**Gerald Weinhouse, MD
Pulmonary Medicine**

**Max Weinmann, MD
Internal Medicine**