

Burns Service: Training and Education

Surgical Critical Care Fellowship

Curriculum Overview

General Goals and Objectives

The Massachusetts General Hospital postgraduate Surgical Critical Care Fellowship is designed to allow Fellows to develop advanced proficiency in the management of all aspects of the care of critically ill surgical patients, and to develop the qualifications necessary to supervise surgical critical care units.

The Fellowship in Surgical Critical Care is primarily a clinical patient care program. The Fellow will spend the majority of his/her time providing care to the ICU patients, supervising residents and medical students, under the supervision of both surgical and critical care Attending staff. They will spend a month at a time in a given ICU. In each ICU rotation, they will round with the surgical teams on their ICU patients in the morning, and then conduct, together with the ICU Attending, morning ICU work/teaching rounds. There is then a daily lecture given by the ICU Attending to the ICU residents, Fellow, and medical student ICU clerks, on a subject of current import. Usually, there is a regular weekly teaching conference in the afternoon, followed by late afternoon ICU work rounds. The balance of the Fellows' day is spent in providing care to the patients, supervising the ICU residents and meeting with consultants, and in doing their own reading and research.

The one-year Fellowship will be comprised of eleven month-long rotations and one month of vacation. At least nine months will be spent in the seven surgical ICU's, with six months in either the Gray Surgical Intensive Care Unit (GrSICU) or the Respiratory Intensive Care Unit (RICU), and one month each in the Pediatric, Neonatal, and the Neurosurgical ICU's. The remaining two months will be elective, with one in either the Transplant, Burn, or Cardiac SICU, and one in the ICU of the Fellow's choice. The exact order of the rotations will be established by the Program Director and the Fellow prior to the beginning of the Fellowship; the first three months will be in the GrSICU and RICU.

Core Curriculum

The Core Curriculum of the Fellowship, as outlined below, is designed to cover all major aspects of the art and science of surgical critical care. This is accomplished through daily ICU Attending lectures weekly ICU conferences and Fellows' conferences.

1. RICU and GrSICU (Drs. Warren and Hurford)

Cardiopulmonary resuscitation: ACLS Provider and Instructor certification; leader of the RICU consult team (called to all cardiopulmonary arrests and all urgent endotracheal intubations in the hospital)

Respiratory: respiratory failure - ARDS; pneumonitis; nitric oxide; ventilator management - ventilator modes; ventilator weaning; respiratory mechanics and work of breathing; barotrauma; care of postoperative thoracic patients, including special considerations for tracheal, bronchoplastic, and reduction pneumoplasty procedures

Cardiovascular: rhythm analysis; therapy of arrhythmias; 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; hemodialysis and ultrafiltration;

GI: enteral nutrition; GI bleeding; liver dysfunction and failure; pancreatitis; management of stomas; ascites; intraabdominal sepsis;

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 infections and catheter-related sepsis; antibiotic drug interactions and dosing

2. Cardiac SICU (Drs. Vlahakes and Torchiana)

Intraaortic balloon pumps and cardiac assist devices; myocardial energy metabolism, ischemia, and failure; prosthetic valves and valve repairs; aortic dissection; epicardial pacing; AICD's; cardiac transplantation; congenital heart disease;

3. Burn Unit (Drs. Tompkins and Sheridan)

Acute burn resuscitation; inhalation injuries; burn wound management; electrical injuries; radiation injuries

4. PICU/NICU (Dr. Ryan) (see also separate outline)

Ventilator management; fluid and electrolyte therapy; nutrition and metabolism; newborn emergencies; pediatric ID issues;

5. Transplant Unit (Dr. Powelson)

Liver, kidney, and pancreas transplantation; liver dysfunction and failure; renal dysfunction and failure; rejection; hemodialysis; transplantation immunology and immunosuppression;

6. Neuro ICU (Dr. Swearingen)

Acute head injury; cerebral blood flow - measurement and management; intracranial pressure monitoring and management; subarachnoid hemorrhage; acute CVA; interpretation of cranial CT and MRI; acute spinal syndromes; nerve regeneration and repair; perioperative management of myasthenia gravis;

Educational Philosophy

The Department of Surgery of the Massachusetts General Hospital believes that the best education comes from extensive clinical "hands-on" experience coupled with regular lectures and seminars/discussions, and both scheduled and self-directed reading. Graded assumption of responsibility is a key feature, with closeness of supervision varying inversely with the expertise level of the student, resident, or fellow. The postgraduate Surgical Critical Care Fellowship is designed to allow fellows to "develop advanced proficiency in the management of" all aspects of the care of "critically ill surgical patients, and to develop the qualifications necessary to supervise surgical critical care units." More specifically, the goals are those stated in "Section III. Objectives", of the "Special Requirements for Residency Training in Surgical Critical Care."

Patient Care Responsibilities

The Surgical Critical Care Fellows will supervise the ICU residents in the care of all ICU patients, and will in turn be supervised by the ICU Attending. The Fellows will round with the surgical resident (operating) teams as they see their ICU patients on morning rounds. They will then conduct, together with the ICU Attending, daily morning work rounds with the ICU residents. The Fellows will spend the day in the Unit, supervising all aspects of the care of the ICU patients, including all procedures, management decisions, and contact with the surgical staff Attending, surgical resident teams, and consultants. The Fellow will take call from home at night, supervising the care by the ICU resident who spends the night in the unit, and coming into the hospital for any issues that require his/her physical presence. They will be on duty for the Unit an average of one out of every three weekends.

Critical Care Knowledge Areas

The Fellows will be taking care of the entire spectrum of critical care patients, working in multiple ICUs with a wealth of clinical material. Over the course of the year they will encounter most if not all of the most important varieties of critical illness. Moreover, the didactic curriculum will cover each of the areas below in more detail. The list below outlines the critical care knowledge areas Fellows acquire during their training.

1. Cardio-respiratory resuscitation: The RICU Fellow is the leader of the RICU consult team, which is called to all hospital cardiopulmonary resuscitations to provide airway management as well as any other assistance that may be required. Each critical care Fellow will become an ACLS Instructor during the Fellowship.

2. Physiology, pathophysiology, diagnosis, and therapy of disorders of the cardiovascular, respiratory, gastrointestinal, genitourinary, neurologic, endocrine, musculoskeletal, and immune systems as well as of infectious diseases. These disorders are encountered every day in the MGH ICU's, and the Fellows will become experienced in dealing with them through repeated exposure.

3. Metabolic, nutritional, and endocrine effects of critical illness. The metabolic and nutritional needs of all ICU patients are carefully addressed every day. The Fellows and residents have daily contact with the Nutritional Support Unit personnel, who follow all patients receiving therapeutic nutrition, both enteral and parenteral. Likewise, the endocrine status of all ICU patients is addressed daily; endocrine specialists are consulted for difficult cases.

4. Hematologic and coagulation disorders. Again, these categories of disorders are encountered daily in our ICU's. Massive transfusion, coagulopathy, and hypercoagulable states are seen with some frequency, due to the high volume of patient flow through the units. Blood Bank personnel and hematologists are readily available for consultation when needed.

5. Critical obstetric and gynecologic disorders. All critically ill gynecologic patients are cared for in the RICU or GrSICU. The MGH high-risk pregnancy unit is planned to be open by March, 1995, and the surgical critical care Fellows will have the opportunity to spend time there.

6. Trauma, thermal, electrical and radiation injury. The MGH is a verified Level I Trauma Center, and admits 1800 major trauma patients annually. All major trauma patients requiring ICU care go to the RICU or GrSICU. The MGH Burn Unit is the primary referral center for all of New England, and likewise treats a large number of seriously burned patients.

7. Monitoring and medical instrumentation. All patients in the ICU's are monitored, most having indwelling arterial lines, and at any one time more than half have PA lines. The Fellows become of necessity quite facile with the use of all critical care monitoring devices. In addition, the didactic component of the curriculum will cover the underlying biophysics and bioengineering principles.

8. Critical pediatric surgical conditions. The two-month rotation in the Pediatric ICU and Neonatal ICU will give the Fellows a solid foundation in pediatric surgical critical care medicine.

9. Pharmacokinetics and dynamics of drug metabolism and excretion in critical illness. A representative of the MGH Pharmacy department regularly attends rounds in the GrSICU and RICU, to provide continuous and timely expert assistance on these matters. These subjects are addressed in nearly every patient. For example, the risks and benefits of once-daily aminoglycoside dosing was the subject of one of the most recent weekly multidisciplinary ICU conferences.

10. Ethical and legal aspects of surgical 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. In addition, there is a biweekly ethics conference, specifically discussing ethical issues that have recently arisen in the RICU and GrSICU.

11. Principles and techniques of administration and management. Again, since they are the nexus of the ICU's, the fellows are intimately involved in making administrative decisions daily. They have the opportunity to work closely with all the different ICU Attendings, and thus to experience their various styles of management.

12. 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 Fellows' conference. A different approach to these subjects is taken during the Fellows' experience with their own clinical research studies.

Specific Critical Care Training

Fellows are provided with specific training to enable them to become proficient in critical care skills:

1. Respiratory: airway management, including endoscopy and management of respiratory systems. In addition to serving as the leader of the RICU consult team, the RICU Fellow takes care of 1 to 4 major general thoracic post-operative patients a day. Bedside flexible bronchoscopy is performed in the RICU an average of three times a day, and the RICU Fellow has ample opportunity to become quite facile with this procedure. The spectrum of respiratory disease seen in the RICU and GrSICU is quite large.

2. Circulatory: invasive and noninvasive monitoring techniques, including transesophageal and precordial cardiac ultrasound and application of transvenous pacemakers; computations of cardiac output and of systemic and pulmonary vascular resistance; monitoring and interpretation of electrocardiograms and management of cardiac assist devices. Although the cardiac ultrasound procedures are always performed by the cardiology fellows, the ICU Fellows are quite often exposed to these procedures in the RICU, GrSICU, and Cardiac SICU. Cardiac assist devices, including IABP, LVAD, and RVAD, are not uncommonly used in the Cardiac SICU. The remainder of the above techniques and procedures are routinely performed in all the ICU's.
3. Neurological: the performance of complete neurological examinations. Use of intracranial pressure monitoring techniques and of the electroencephalogram to evaluate cerebral function and application of hypothermia in the management of cerebral trauma. The Fellows will spend a month in the Neurosurgical ICU, which is devoted solely to critically ill neurosurgical and neurological patients, and is under the joint direction of a neurologist and neurosurgeon. In addition to this experience, the Fellows in the RICU and GrSICU have a weekly Neuro-Critical Care rounds.
4. Renal: the 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 ICU's. Our Renal Unit is very aggressive, and bedside dialysis, CVVHF and CVVHD are required quite frequently.
5. 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.
6. Hematologic: application of autotransfusion, assessment of coagulation status, and appropriate use of component therapy. Autotransfusion is used in all post-cardiac surgical patients in the Cardiac SICU and routinely in patients with traumatic hemothorax. Bleeding disorders and their treatment are common in our ICU population; the Blood Bank and hematology personnel are quite helpful in consulting on these patients when required.
7. Infectious Disease: classification of infections and application of isolation techniques, pharmacokinetics, drug interactions, and management of antibiotic therapy during organ failure; nosocomial infections; indications for and applications of hyperbaric therapy. 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.
8. Nutritional: application of parenteral and enteral nutrition, and the monitoring and assessment of metabolism and nutrition. Again, nutrition is addressed daily in every ICU patient, and consultation with the Nutrition Support Unit personnel is obtained whenever nutritional therapy is used. The NSU consultants, as with all consultants in our ICU's, are very helpful in teaching and making recommendations, but the decisions and details of management are left to the primary caregivers, the residents, Fellows, and surgical and ICU Attendings.
9. Monitoring/Bioengineering: use and calibration of transducers, amplifiers, and recorders. The Fellows receive thorough training on these subjects through constant use as well as through didactic presentations.
10. Miscellaneous: use of special beds for specific injuries, employment of pneumatic antishock garments, traction, and fixation devices. Since all major trauma patients are cared for in the RICU and GrSICU, the Fellows have quite a bit of experience with these devices. They also receive didactic presentations from both the nursing staff, the company representatives, and the orthopedic medical staff.

Conferences

There are several regularly scheduled weekly conferences. The RICU and GrSICU Fellows are responsible for planning and inviting speakers to the weekly ICU conference on Fridays at noon. They collect all the morbidity and mortality data for the RICU and GrSICU and present them at the monthly RICU/GrSICU Morbidity and Mortality conference. They are also responsible for giving presentations at the ICU Fellows conference on the topic of the week; these topics include research-level physiology and pathophysiology, examination and discussion of current clinical studies in critical care medicine, including studies performed by them in our ICU's. The Fellows choose which patients the residents present at Neuro-critical care and critical care infectious disease rounds. They give a 30 minute presentation on a current critical care topic once a month at Trauma Rounds, and will be tasked with giving 20 to 30 minute presentations at Surgical Grand Rounds, Thoracic Surgical Grand Rounds, Cardiac Surgical Grand Rounds, and Pediatric Surgical Grand Rounds once or twice a year.

Teaching Responsibilities

One of the primary roles of the critical care fellows is teaching the residents and medical students. This is done by supervising them during the course of caring for the patients; the formal didactic/lecture education of the residents is the responsibility of the Attending staff.

Research Responsibilities

Each Fellow will be expected and carry out, in conjunction with at least an ICU Attending, at least one clinical study in critical care medicine. Ample computer facilities are available for data management, writing, and literature searching. The MGH Medical Records Department provides excellent assistance in performing chart reviews. All the faculty are actively involved in clinical research. There are dozens of basic science laboratory facilities under the direction of MGH staff surgeons, all of which would welcome any interest by the Fellows. There is not enough time in the one-year Fellowship to perform any meaningful laboratory investigation; however, if a Fellow desires, an additional year or more could be arranged in one of the laboratories for such work.

Evaluation

Of Fellows: The Fellows will be evaluated in written format both by the residents and by the faculty they work with on a monthly basis. These will be reviewed monthly by the Fellowship Program Director, who will in turn provide monthly (or more often if required) feedback to the Fellow. The Fellowship Program Director will review the evaluations with the Surgical Residency Program Director on at least a quarterly basis.

Of Faculty: The surgical faculty are all evaluated in written format by each resident and each Fellow that they have supervised on a monthly basis. The evaluations by the residents are reviewed by the Surgical Residency Program Director and by the Chief of Surgery, and the faculty members are provided feedback from these evaluations on at least a yearly basis, more often if problems arise. Likewise, the evaluations by the Fellows will be reviewed the Fellowship Program Director and the Chief of Surgery, and feedback to the faculty given in the same way. The Chief of Surgery will review the performance of the Fellowship Program Director based on evaluations by the residents, Fellows, and other faculty members.