

**Cardiothoracic Intensive  
Care Unit (CTICU) Rotation**  
Goals & Objectives

**I. GOALS**

The goals of this rotation are to train residents to become proficient in the practice of cardiothoracic surgical critical care medicine by developing competent skills in the theory, diagnosis, and treatment of a host of complex cardiothoracic-related medical, surgical and traumatic disorders resulting in critical illness. The ICU team in association with a cardiothoracic attending physician sees all patients on the assigned cardiothoracic critical care service daily. Residents are evaluated by the ICU attending by direct observation of the resident's delivery of patient care, diagnostic skills, proficiency in performing procedures, and mastery of the knowledge base of cardiothoracic critical care medicine. Residents will gain familiarity with health care delivery within the context of the Loma Linda University Health Sciences system. The goals of this rotation will include the following

1. Achieve proficiency in the recognition and management of basic and complex cardiothoracic-related medical, surgical and traumatic disorders encountered in patients in the cardiothoracic intensive care unit.
2. Develop the cognitive and procedural skills necessary to provide optimal medical care to patients with cardiothoracic-related disorders resulting in significant physiologic derangements.
3. Develop a more sophisticated knowledge through the use of electronic medical information resources (PubMed, Cochrane Database, EMBASE, National Guidelines Clearing House), subspecialty textbooks, and other relevant sources, particularly as such knowledge applies to medical disorders in the context of critical illness, alone or as part of a multisystem disease process.
4. Residents will learn diagnostic and treatment decisions by analyzing and synthesizing medical information.
5. Defend management plans using evidence-based medicine (EBM)
6. Residents will learn a variety of invasive procedures, including the ability to correct complications resulting from these procedures.
7. Develop proficiency with different modes of mechanical ventilation
8. Develop proficiency with interpretation of acid-base disturbances
9. Refinement of basic proficiency with the indications for bronchoscopy.
10. Develop the ability to safely perform diagnostic and therapeutic thoracentesis
11. Develop an appreciation and understanding of hemodynamic and pharmacologic support of patients with complex cardiothoracic-related disorders.
12. Identify patient care situations requiring complex management and participate, if requested, in patient-centered care conferences
13. Demonstrate the ability to identify common abnormalities on chest radiologic imaging studies (including plain films, CT scans, & MRI imaging) and provide an initial differential diagnosis
14. Develop a better knowledge of current guidelines and standards of care for the management of patients with cardiothoracic-related medical, surgical and traumatic disorders developed by relevant medical organizations such as the Society of Critical Care Medicine, the American College of Chest Physicians, the

American Thoracic Society, and the American Boards of Anesthesiology & Surgery.

15. Develop enhanced communication skills, both verbally and in writing, as required of a physician in a consultant role.
16. Gain experience with the supervision of a team of health care providers; i.e. residents, medical students, nurses, respiratory therapists, etc. Provide expert care and training to other physicians and students involved in managing critically ill or unstable patients with cardiothoracic-related disorders.
17. Provide opportunities to develop teaching skills (i.e. residents, medical students, nurses, respiratory therapists etc).
18. Evaluate and incorporate new treatment techniques for patients with cardiothoracic-related disorders in a rapidly growing and evolving system of healthcare resources and delivery models.
19. Develop a better understanding of the role that an intensivist has in the provision of palliative care and end of life discussions

The following overall objectives, **arranged by general competencies**, apply to all residents assigned to the CTICU rotation. The evaluation methods used to assess those competencies are listed in parentheses after each competency.

## II. Objectives

### A. Patient Care

**Residents are expected to provide patient care that is compassionate, appropriate and effective for the promotion of health, prevention of illness, treatment of disease, and palliation at the end of life**

During the CTICU rotation, the resident will:

1. Demonstrate proficiency in use of LLUMC information systems technology (LLEAP, EPRS, IMPAX) to assist in patient care.
2. Gather essential and accurate information for the provision of critical care services by performing complete and clinically relevant history and physical examinations.
3. Review the history and physical findings with the supervising faculty and confirm key elements.
4. Provide initial care and management recommendations for CTICU patients following cardiac, thoracic, and vascular surgery.
5. Use information technology (PubMed, Cochrane Database, National Guidelines Clearing House) to support patient care decisions and patient education.
6. Gain an awareness and understanding of how to order and interpret appropriate diagnostic tests for patients with cardiothoracic-related critical illnesses.
7. Perform and supervise a variety of invasive procedures competently including the ability to correct complications resulting from these procedures.
8. Develop the skills required to safely perform bronchoscopic examinations.
9. Demonstrate an understanding of the indications for thoracostomy tube placement and the ability to safely perform the procedure under direct attending supervision.
10. Demonstrate an understanding of the complications of thoracostomy tube placement and the management of such complications

11. Demonstrate an understanding and the ability to safely perform diagnostic and therapeutic thoracentesis, and an awareness of the appropriate tests to order as guided by the differential diagnosis.
12. Demonstrate the ability to identify common abnormalities on chest radiography and CT/MRI imaging of the chest and provide an initial differential diagnosis.
13. Develop and carry out care plans as well as develop superb communication abilities.
14. Routinely participate in conversations with family members to gather other clinical information, understand the patient's and family's wishes.
15. Develop an awareness and understanding of the processes involved in end-of-life discussions and in recommending and arranging for palliative care.

## **B. Medical Knowledge.**

**Residents are expected to demonstrate knowledge of established and evolving biomedical, clinical and social sciences, and the application of their knowledge to patient care and the education of others.**

Medical knowledge in the area of cardiothoracic surgery-related critical illnesses is obtained by participating in direct patient care in the CTICU setting, attending didactic lectures including critical care lectures and case conferences, developing an individual study program, and in asking relevant questions.

Residents will be expected to demonstrate the following knowledge and procedural skills:

1. Develop a familiarity with the preanesthetic evaluation and preparation of adult cardiothoracic patients
2. Pharmacokinetics and pharmacodynamics of medications prescribed for medical management of adult cardiothoracic patients
3. Pharmacokinetics and pharmacodynamics of medications prescribed for management of hemodynamic instability: inotropes, chronotropes, vasoconstrictors and vasodilators
4. Circulatory assist devices, intra-aortic balloon counterpulsation, left and right ventricular assist devices and ECMO.
5. Pacemaker insertion, modes of action, diagnosis and correction of malfunctions.
6. Familiarity with a variety of cardiac surgical procedures: myocardial revascularization, valve repair and replacement, pericardial, neoplastic procedures, and heart transplantation
7. Familiarity with thoracic aortic surgery procedures: ascending, transverse, and descending aortic surgery with circulatory arrest, CPB employing low flow and or retrograde perfusion
8. Familiarity with esophageal surgery for varices, neoplastic disease, colonic interposition, foreign body removal, stricture and tracheoesophageal fistula

9. Familiarity with pulmonary surgery procedures: thoracoscopic or open, lung reduction, bronchopulmonary lavage, one-lung ventilation, lobectomy, pneumonectomy and bronchoscopy: endoscopic, fiberoptic, rigid and laser resection
10. To be familiar with the epidemiology, risk factors, and the management of commonly encountered cardiothoracic-related medical, surgical and traumatic disorders appearing in the cardiothoracic critical care setting, including:
  - The systemic inflammatory response syndrome (SIRS)
  - Sepsis and septic shock
  - Multi-organ dysfunction syndrome
  - Acute pulmonary embolism
  - Acute renal failure, particularly in the context of cardiac surgery
  - Acute coronary syndromes (unstable angina, NSTEMI, STEMI) and the value of surgical coronary revascularization procedures
  - Acute heart failure (diastolic, systolic), particularly in the context of cardiothoracic surgery
  - Pericardial tamponade, particularly following cardiac surgery
  - Postoperative mediastinal bleeding
  - Mediastinal/sterna wound infections
  - Bronchopleural fistula
  - Cardiac rhythm disturbances (supraventricular, ventricular)
  - Aortic dissection: medical & traumatic
  - Severe cardiac valvular disease requiring valvular repair/replacement
  - Bacterial endocarditis, particularly severe disease requiring surgical therapy
  - Postoperative pericarditis/pericardial effusion
  - Acute ischemic and hemorrhagic stroke in the cardiothoracic surgical context
  - Seizures
  - Diabetic ketoacidosis and nonketotic hyperglycemic coma
  - Severe electrolyte disturbances
  - Shock states
  - Coma-evaluation and treatment (including brain death)
11. Develop an awareness of the relative prevalence rates and risks for the development of critical diseases in individuals based on previous clinical conditions, type of cardiac surgical or procedural interventions, and demographics such as age and gender.
12. To know the signs, symptoms, clinical course, complications and treatment of patients with difficult-to-treat pulmonary conditions in the context of cardiothoracic surgery:
  - Acute respiratory failure, including acute lung injury, aspiration pneumonitis, surgical pulmonary contusions, and obstructive sleep apnea.
  - Pulmonary hypertension in the cardiothoracic surgical context
  - Hospital-acquired pneumonia
  - Acute exacerbation of COPD
  - Pneumothorax (pneumo- and hemothorax)
  - Pleural effusions
  - Empyema
  - Acute respiratory distress syndrome, particularly following cardiothoracic surgery

- Refractory hypoxemia related to atelectasis in the setting of cardiothoracic surgery
13. Develop a familiarity with non-invasive cardiovascular evaluation: electrocardiography, echocardiography (TTE and TEE), stress testing and cardiovascular imaging. (TEE education will be based upon the training objectives for perioperative echocardiography of the American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists outlined in “Guidelines for Training in Perioperative Echocardiography”.); cardiac catheterization procedures and their diagnostic interpretation, invasive cardiac catheterization procedures, including angioplasty, stenting, transcatheter laser treatments and mechanical ablations)
  14. To understand the role, principles and limitations of physiologic monitoring and diagnostic laboratory tests commonly used for pulmonary diseases within the critical care setting, including:
    - Indications, techniques for placement, complication recognition & management of invasive intravenous catheters including arterial lines, central lines, cavity drains and thoracostomy tubes
    - Knowledge of common laboratory tests including blood chemistries, microbiology interpretation
    - Uses and limitations of monitoring based upon pulse-wave contour analysis
    - Uses and limitations of monitoring based upon aortic blood flow velocity
    - Uses and limitations of monitoring based upon mixed central venous oxygen saturation
  15. Develop a familiarity with the diagnosis and treatment of patients with pulmonary hypertension (primary and secondary) in the context of cardiothoracic-related disorders
  16. Identify common and unusual abnormalities on chest plain film and CT radiography
    - Cardiac and individual chamber enlargement (right and left heart)
    - ARDS pattern
    - Pneumonia
    - Atelectasis (lobar, subsegmental)
    - Pleural effusions, including loculated
    - Abscess
    - Interstitial pulmonary processes (reticular, nodular, honeycombing)
    - Emphysema
    - Pneumothorax and pneumomediastinum
    - Pulmonary artery hypertension (identification, causes)
    - Mechanical devices (invasive lines, pacemakers, cardiac-assist devices) within the chest
  17. Pain management of adult cardiothoracic surgical patients
  18. Ethics: end-of-life care and principles of withdrawal of care

### **C. Practice-Based Learning and Improvement**

**Residents are expected to be able to use scientific evidence and methods to investigate, evaluate, and improve patient care practices.**

Specifically, the residents are expected to 1) identify areas for improvement and implement strategies to enhance knowledge, skills, attitudes and processes of care 2) analyze and evaluate practice experiences and implement strategies to continually improve the quality of patient practice 3) develop and maintain a willingness to learn from errors and use errors to improve the system or processes of care and 4) use information technology or other available methodologies to access and manage information, support patient care decisions and enhance both patient and physician education.

1. To keep logs of all major procedures including difficult airways, bronchoscopy, thoracentesis, paracentesis, pericardiocentesis, temporary transvenous pacemaker placement, and percutaneous tracheostomy placement.
2. To use current evidence-based practice guidelines to manage critically ill patients, and to obtain additional supervision when existing guidelines require supplementation with experience-based practices for unique and individual cases.
3. To access and use electronic medical information as pertains to patients' diagnosis and treatment in the form of reference texts, searches, electronic journals such as UpToDate, e-Medicine, PubMed, MDConsult, Cochrane Library, and other networked resources as made available through the Loma Linda University Library.
4. To critically read and discuss the relevant scientific literature presented in Journal Club, (and on rounds) while seeking application to actual practice.
5. Support ongoing basic and clinical science protocols in the CTICU by participating in candidate identification or in proposing future projects
6. To facilitate the learning by other health care professionals and trainees with regard to pulmonary-related disorders.

#### **D. Professionalism**

**Residents are expected to demonstrate behaviors that reflect a commitment to continuous professional development, ethical practice, an understanding and sensitivity to diversity and a responsible attitude toward their patients, their profession, and society.**

During the rotation, the resident will be expected to demonstrate the following:

1. Document all relevant diagnostic and treatment encounters with patients through effective medical record keeping.
2. Demonstrate accountability, reliability, and punctuality during performance of all responsibilities and duties.
3. Demonstrate a balance between independence and recognition of limits of competence/experience
  - a) Heightened awareness when engaged in procedures with higher than average complexity including the performance of difficult bronchoscopic procedures, challenging thoracenteses, chest tube placement, and thoracentesis procedures.
  - b) An awareness of complex pulmonary diseases requiring increased attending involvement and/or additional personal study and research

4. Demonstrate the ability to conduct oneself in an ethically and legally sound manner with respect to issues such as maintenance of treatment boundaries, patient confidentiality, informed consent, provision or withholding of clinical care, and good business practices.

#### **E. Interpersonal and Communication Skills**

**Residents are expected to demonstrate interpersonal and communication skills that enable them to establish and maintain professional relationships with patients, families, and other members of health care teams.**

The Resident will be expected to demonstrate the following:

1. Provide effective and professional assistance to other physicians and health care professionals and sustain therapeutic and ethically sound professional relationships with patients, their families, and colleagues.
2. Use effective listening, nonverbal, questioning, and narrative skills to communicate with patients and families
3. Counsel and educate patients and families as appropriate in a consultative role
4. Interact with other medical consultants in a respectful, appropriate manner
5. Communicate clearly, correctly, and concisely in a written medical record note, stressing the important issues and an articulate plan regarding the surgical and/or traumatic disorder for which the patient is being treated.
6. Maintain comprehensive, timely, and legible medical records
7. Use nomenclature and writing standards consistent with that of the institution
8. Display support & empathy to patients and their families, as witnessed by attending staff or reported to staff
9. Consider ethical issues and patient wishes in treatment decisions

#### **E. Systems-Based Practice**

**Residents are expected to demonstrate both an understanding of the contexts and systems in which health care is provided, and the ability to apply this knowledge to improve *and optimize health care*.**

Residents will be expected to:

1. Understand the management of critically ill cardiothoracic-related disorders patients in the “managed care” environment, and how one tailors a patient's treatment recommendations to the resources available without compromising quality care.
2. Understand quality improvement processes in the context of cardiothoracic critical illness, and how to partner with health care managers and providers to assess, coordinate and improve care.

3. To develop awareness of cost-effectiveness issues in the context of clinically unstable patients, and how these are managed in different treatment settings such as the CTICU vs. other critical care units (e.g. medical ICU, surgical ICU).
4. Recognize how intensive care services are documented, coded, billed, and reimbursed in critical care practices.
5. Recognize and describe basic compensation methodologies for critical care services.
6. To act as a patient advocate for helping patients and families navigate through sometimes complex and bureaucratic systems related to their health-care needs, patient wishes and resources available.
7. To appreciate the necessity and rationale for various program policies and procedures as such policies may affect the recommendations by the intensivist.
8. Understand, access, and utilize the resources, providers and systems necessary to provide optimal consultative care.
9. Apply evidence-based, cost-conscious strategies to diagnosis and disease management recommendations, as appropriate in the context of a critically ill patient.
10. Collaborate with other members of the health care team to assist patients in dealing effectively with complex systems and to improve systematic processes of care
11. Establish multidisciplinary relationships needed to effect quality care.
12. Participate in coordinated multidisciplinary patient care plans, as appropriate for the physician in a consultative role.
13. Participate actively in cardiothoracic surgery critical care medicine or multidisciplinary QI or case conferences.