Surgical Critical Care Fellowship

Goals and Objectives

Medical Knowledge

1. Physiology
    a. Describe concepts of normal physiology:
        i. Cell differentiation and growth
        ii. Endocrine and autocrine regulation of growth, metabolism, homeostasis
        iii. Basic genetics
        iv. Metabolism in pregnancy
        v. Nutrition and metabolism
        vi. Regulation of hemodynamics of the cardiovascular system
        vii. Hemostasis, coagulation, thrombogenesis and fibrinolysis
        viii. Mechanics of ventilation and gas exchange
        ix. Inflammation and wound healing
        x. Wound Healing
        xi. Oncogenesis
        xii. Neuroendocrine system
        xiii. Neurology
        xiv. Renal System
    b. Identify physiologic variations in each of the systems as related to geriatrics, pediatric, immunosuppressed and pregnant patient populations.
    c. Identify physiologic variations in each system as related to hemodynamic instability: neurogenic shock, septic shock, hypovolemic shock, cardiogenic shock
    d. Understand normal values/ranges of clinical tests.
    e. Describe the applications of physiologic principles to surgical monitoring and therapy
    f. Understand physiologic variations in surgical monitoring as related to geriatric, pediatric and pregnant patient populations.
    g. Describe the physiologic effects of complex disease processes
2. Fluid and Electrolyte Homeostasis
    a. Describe water volume distribution of the body.
    b. Understand the osmotic, oncotic, and electrolyte composition of cells, tissues and intravascular volumes. Including the concentration of the following electrolytes in each compartment:
        i. Sodium
        ii. Potassium
        iii. Chloride
        iv. Bicarbonate
        v. Calcium
        vi. Magnesium

vii. Phosphate

c. Understand the different electrolyte composition of the following fluids:
    i. Blood/Plasma
    ii. Urine
    iii. Saliva
    iv. Gastric Secretions
    v. Pancreatic Secretions
    vi. Bile
d. Understand the normal endocrine regulation of fluid and electrolyte homeostasis, and the underlying changes that influence fluid balance during the stress response as exhibited by:
    i. Vasopressin
    ii. Renin
    iii. Angiotensin
    iv. Aldosterone
    v. Hydrocortisone/Methylprednisone
    vi. Adrenocorticotropic Hormone
e. Understand the effects of fluid composition and balance in geriatric, pediatric, pregnant patients. Specifically evaluating the underlying etiology/pathology resulting in and the treatment of the following conditions:
    i. Hypernatremia/Hyponatremia
    ii. Hyperkalemia/Hypokalemia
    iii. Hyperchloremia/Hypochloremia
    iv. Hypercalcemia/Hypocalcemia
    v. Hypermagnesemia/hypomagnesemia
    vi. Hyperphosphatemia/Hypophosphatemia
f. Understand the role of diuretics and exogenous hormone treatment in fluid balance and electrolyte abnormalities.
g. Discuss the changes related to patient age and renal function as it relates to fluid balance and sodium regulation:
h. Outline the pathophysiology of fluid and electrolyte derangement in:
    i. Cardiac Surgery
    ii. Aortic Surgery
    iii. Peripheral Revascularization
    iv. Crush Injury/Compartment Syndrome

3. Acid-Base Homeostasis
    a. Comprehend hydrogen ion biochemistry and physiology:
        i. Use Henderson-Hasselbach equation
            1. Understand ventilatory component (pCO_2)
            2. Understand renal component (HCO_3)
        ii. Hydrogen ion production and disposal
        iii. Physiologic Buffers
            1. Bicarbonate
            2. Renal, bone and pulmonary
    b. Understand the role of gas exchange in the maintenance of acid-base homeostasis at the alveoli at the alveolar/capillary interface.
    c. Describe the renal production of bicarbonate, relationship of hydrogen and potassium in the maintenance of acid-base hemostasis.

d. Summarize the contributions of the RBC membrane, bone, kidneys, and lungs in the maintenance of normal pH.
e. Describe the difference between anion and non-anion gap acidosis.
f. Know the causes and treatment for metabolic acidosis.
g. Analyze information provided in blood gas analysis:
    i. Metabolic acidosis/alkalosis
    ii. Respiratory acidosis/alkalosis
    iii. Mixed abnormalities
h. Provide appropriate vent and fluid treatment for these derangements in acid-base homeostasis.
i. Understand age-associated changes in respiratory and renal regulatory processes.
j. Review surgical causes of acid-base derangement:
    i. Bowel Obstruction/emesis
    ii. Fistulas
    iii. Uretero-ileal conduit
    iv. Hypoperfusion secondary to ischemia/vascular compromise
k. Review medical causes of acid-base derangement:
    i. Diabetic ketoacidosis
    ii. Hypoperfusion secondary to shock
    iii. Renal Insufficiency
    iv. Respiratory Failure
l. Summarize the effects of acid-base disturbances on the following systems:
    i. Central Nervous System
    ii. Oxygen delivery
    iii. Respiratory Function

4. Metabolism
    a. Section 1: Energy
        i. Describe the principles of energy conversion to mechanical work and the efficiency of energy conversion and thermal balance.
        ii. Define basic energy units such as the calorie and kilocalorie.
        iv. Discuss heat loss and its relationship to heat balance.
        v. Relate oxygen consumption and carbon dioxide production to thermogenesis, energy production and measurement of energy balance by indirect calorimetry.
        vi. Explain the respiratory quotient, its usefulness in determining substrate utilization patterns and its relationship to respiratory function.
        vii. Define basal resting metabolic rates and their relationship to body weight, size, gender and age.
        viii. Understand the changes in nutritional requirements for acute and chronic changes in liver, pancreatic, renal and pulmonary systems.
        ix. Predict daily energy requirements using metabolic rate equations.
        x. Discuss the effects of ambient temperature, injury, burn, infection, pain, fear, anxiety and starvation to the energy requirements.
        xi. Predict the efficacy of substrate utilization: absorption and metabolism during the septic state.
        xii. Integrate the above knowledge with prediction equations to estimate metabolic demands of critically –ill patients (Harris-Benedict Equation).

xiii. Discuss how different substrates contribute to specific disease processes.
iii. Understand the benefits and potential pitfalls of parenteral nutrition.
iv. Understand the benefits and limitations of enteral nutrition in post-surgical patients.
v. Discuss the different modalities for enteral feeding and potential pitfalls.
vi. Describe the role of trace minerals, essential fatty acids, and essential amino acids in normal homeostasis.

b. Section 2: Temperature and Fuel Homeostasis
   i. Describe how the brain controls temperature and responds to stress and disease states.
   ii. Describe the endocrine mediators of temperature set-point, the response to fever and the resulting changes in oxygen consumption.
   iii. Describe the inflammatory mediators of fever.

c. Section 3: Hormonal Control of Metabolism
   i. Identify the hormones responsible for normal storage and utilization of protein, fat and carbohydrate.
   ii. Identify the normal response of muscle, gut, liver, pancreas to these hormones.
   iii. Describe alterations in substrate utilization in fasting, early starvation, prolonged starvation.
   iv. Describe the alterations hormone regulation during the stress response and the resulting changes in substrate mobilization and utilization.
   v. Discuss the systemic effects of corticosteroids in the response to injury and infection.
   vi. Define the role of glucocorticoids on nitrogen balance and protein metabolism.
   vii. Describe the role of growth hormone and thyroid hormone on metabolism.

5. Nutrition
   a. Discuss risk factors contributing to malnutrition in the hospitalized patient, including:
      i. Low nutritional reserve
      ii. Extensive preoperative studies
      iii. Lack of oral intake secondary to underlying disease process
      iv. High Stress Conditions
   b. Summarize the characteristics of the indicators for nutritional assessment, including:
      i. Weight loss greater than 10% of ideal body weight
      ii. Serum albumin less than 3.4 gm/dl
      iii. Impaired immune response: anergic response and total lymphocyte count less than 1500/mcl
      iv. Specific changes on physical exam
   c. Analyze methods of nutritional assessment using:
      i. Pertinent history
      ii. Anthropomorphic measurements
      iii. Laboratory measurements

iv. Immunologic measurements

d. Understand the nutritional challenges associated with geriatric patients, including:
    i. Protein-energy undernutrition
    ii. Vitamin deficiencies
    iii. Trace mineral deficiencies
    iv. Obesity
e. Explain methods of calculating energy requirements, including:
    i. Simple estimate
    ii. Harris-Benedict equation
    iii. Nitrogen balance
    iv. Basal metabolic cart
f. Analyze the metabolic response to starvation and stress.
g. Provide general guidelines for determining nutritional composition:
    i. Non-protein to protein calorie ratio
    ii. Protein requirements
    iii. Carbohydrate/fat balance
    iv. Effects of nutrition on renal, respiratory, hepatic function
h. Summarize common problems associated with malnourished geriatric patients, including:
    i. Cognitive impairment
    ii. Poor wound healing
    iii. Anemia
    iv. Bruising
    v. Increased risk of infection
    vi. Increased risk of underlying malignancy
i. Understand the benefits and potential pitfalls of parenteral nutrition.
j. Understand the benefits and limitations of enteral nutrition in post-surgical patient
k. Discuss the different modalities for enteral feeding and potential pitfalls.
l. Summarize content and special formulations for patients with:
    i. Congestive heart failure
    ii. Liver failure
    iii. Renal failure
    iv. Respiratory failure
    v. Glucose intolerance
m. Explain the advances in surgical nutrition, including:
    i. Glutamine
    ii. Arginine
    iii. Omega-3 fatty acids
    iv. Growth factors
n. Highlight the role of tight glucose control in surgical patients, including:
    i. Infection
    ii. Wound healing

6. Hematology
    a. Section I: Hematology, Hematopoiesis and Inflammation
        i. Describe the fundamental components of hematopoiesis, including the development of lymphocytes and hematopoietic cells from multipotent

progenitor cells.

ii. Discuss the structure, function, production and degradation of hemoglobin.
iii. Discuss the structure, function, lifespan, metabolic activity and degradation of red blood cells.
xiv. Outline and compare the common congenital and acquired anemias, such as those associated with:
    1. Decreased functional red blood cell mass.
    2. Increased premature destruction of red blood cell mass.
iv. Describe the implications of polycythemia in surgical patients.
v. Describe the hemoglobinopathies and management of these disorders in surgical patients.
vi. Understand the inflammatory cascade, the intrinsic and extrinsic immune response, including the role of:
    1. Endothelial elements, fibroblasts, tissue macrophages
    2. Granulocytes, monocytes, platelets
    3. Lymphocytes
        a. T lymphocytes
        b. B lymphocytes
vii. Understand the cytokine regulation of the immune response, including the autocrine and endocrine response to inflammation.
viii. Discuss platelet production and physiology.
ix. Discuss the effects of common drugs in hematopoiesis.

b. Section 2: Hemostasis, Coagulation and Fibrinolysis
    i. Discuss the phases of normal hemostasis, including:
        1. Primary hemostasis (vasoconstriction and platelet plug formation)
        2. Secondary hemostasis (activation of the clotting cascade and formation of the fibrin clot)
    ii. Understand the cellular and molecular events involved in platelet activation.
    iii. Identify endogenous clotting factors and fibrinolytic factors.
    iv. Understand the intrinsic and extrinsic clotting cascades and their respective mechanisms of activation.
    v. Describe the interaction of blood flow, endothelium, thrombomodulin and fibrinolysis in the control of hemostasis.
    vi. Discuss the indications, methods and pitfalls of the following tests of coagulation:
        1. Activated partial thromboplastin time
        2. Prothrombin time
        3. Thrombin time
        4. Bleeding time
        5. Platelet aggregation studies
    vii. Indicate the mode of action for the following medications that affect coagulation:
        1. Heparin
        2. Coumadin
        3. ASA and other non-steroidal anti-inflammatory drugs

4. Plavix

viii. Identify congenital coagulopathies and summarize considerations in the diagnosis and management of surgical patients.

ix. Identify and discuss the pathophysiology and management of acquired disorders of coagulation:
    1. Disseminated intravascular coagulation
    2. Dilutional Thrombocytopenia
    3. Extracorporeal Circulation
    4. Vitamin K deficiency
    5. Uremia
    6. Liver failure
    7. Hypothermia

x. Differentiate between the pathophysiology, diagnosis and management of hypercoaguable states:
    1. Protein C deficiency
    2. Protein S deficiency
    3. Antithrombin III deficiency
    4. Antiplatelet antibody
    5. Factor V Leiden

xi. Discuss the various aspects of pharmacologic therapy to modify hemostasis, including:
    1. Agents that modify platelet function
    2. Heparin
    3. Coumadin
    4. Hirudin
    5. Epsilon aminocaproic acid and other anti-fibrinolytic agents

xii. Describe the methods for reversal of these agents.

xiii. Discuss the indications and complications of fibrinolytic therapy.

xiv. Understand risk factors for the development of deep venous thrombosis.

xv. Differentiate mechanical and chemical prophylaxis for deep venous thrombosis.

xvi. Describe patients with mitigating factors that contra-indicate medical therapy targeting prophylaxis for deep venous thrombosis.

xvii. Discuss the complications of failed deep venous thrombosis therapy, including diagnosis and management.

xviii. Describe short-term and long-term therapeutic options for patients who have failed deep venous thrombosis prophylaxis.

xix. Understand the long term risk and potential complications for patients requiring chronic anticoagulation therapy.

c. Section 3: Transfusion Therapy

i. Discuss the clinical and economic rationale for blood component transfusion therapy.

ii. Describe the method of preparing, handling and use of additives for the following blood components:
    1. RBC’s
    2. Platelets
    3. Fresh frozen plasma

4. Cryoprecipitate
5. Factor Concentrates

iii. Understand the indications for blood component transfusion therapy.
iv. Understand the elements of informed consent.
v. Explain the principles of blood typing and transfusion therapy, including the indications and complications:
    1. Major and minor blood group antigens and their laboratory evaluation
    2. Blood components and indications for transfusion
    3. Risks of transfusion and possible complications
    4. Indications and methods for autotransfusion and autologous blood donation
vi. Explain the significance of the following:
    1. Major and minor blood group antigens
    2. Role of autoantibodies
    3. Blood screening, typing and compatibility testing
vii. Discuss the features of immediate transfusion reactions:
    1. Fever
    2. Allergic reaction
    3. Hemolysis
viii. Asses the risk of transfusion-related infections:
    1. Acquired immune deficiency syndrome
    2. Hepatitis
    3. Cytomegalovirus
ix. Discuss the methods, indications and benefit of autologous blood transfusion
x. Discuss the indication and treatment of surgical patients with hematopoietic growth factors:
    1. Erythropoietin
    2. Granulocyte colony stimulating factor
xi. Explain the mechanism, application and limitations of intraoperative blood transfusion.
xii. Describe the indications for treatment with ddAVP in patients with platelet dysfunctions.

7. Surgical Infections
    a. Section 1: Mechanisms of Infection
        i. Discuss the mechanism of infection in surgical patients, including:
            1. Mode of transmission
            2. Patient risk factors
            3. Methods of prevention
            4. Community acquired
            5. Procedure related
            6. Nosocomial
        ii. Explain the contribution of both inoculum and virulence affect infection rate.
        iii. Discuss local and systemic adjuvant factors that contribute to infection rate.
        iv. Discuss host defense mechanisms involved in the formation of localized

abscess formation.

v. Demonstrate an understanding of correct hand washing, barrier, and sterile technique in the prevention of infectious disease transmission.
vi. Understand the surgical wound classification.
vii. Recognize the role of hospital surveillance programs in preventing transmission of disease.
viii. Understand the impact of the following factors in surgical infections:
    1. Length of surgery
    2. Appropriate administration of peri-operative antibiotic prophylaxis
    3. Electrocautery
    4. Suture material
    5. Use of clippers
    6. Pre-operative skin preparation
ix. Recognize the common signs of severe infection:
    1. Altered mental status
    2. Leukocytosis
    3. Anorexia
    4. Ileus
    5. Respiratory rate
    6. Serum glucose
x. Demonstrate an appreciation for alterations in normal presentation of infection in geriatric, pediatric, pregnant and immunosuppressed patients.
xi. Discuss the source and common manifestation of Gram-positive, Gram-negative and mixed flora infections.

b. Section 2: Surgical Infections
    i. Describe mode of transmission, diagnosis and treatment of surgical infections, including:
        1. Pneumonia
        2. Urinary tract infections
        3. Wound infections
        4. Complex soft tissue infections
        5. Abdominal contamination and abscess formation
    ii. Discuss the organisms responsible for necrotizing soft tissue infections. Understand etiology, recognition resuscitation and appropriate surgical therapy.
    iii. Differentiate between the types of postoperative pneumonia, including diagnosis and treatment of:
        1. Non-ventilator associated
        2. Ventilator associated
        3. Aspiration acquired
    iv. Understand the etiology, detection and treatment of intra-abdominal abscesses.
    v. Recognize and manage the following:
        1. Cellulitis
        2. Lymphangitis
        3. Lymphadenitis

4. Cutaneous abscess
5. Necrotizing soft tissue infection
6. Necrotizing Fasciitis

vi. Outline the guidelines for tetanus and splenectomy prophylaxis in surgical patients.
vii. Summarize the characteristics of high risk patients requiring prophylaxis and the characteristic presentation of fungal in surgical patients.
viii. Outline the management strategies for the prevention, diagnosis and treatment of infected catheters, implantable devices and surgical hardware.

c. Section 3: Antibiotics
   i. Summarize the indications and appropriate treatment for prophylaxis with antibiotics for the following:
      1. Clean procedures
      2. Clean-contaminated procedures
      3. Contaminated procedures
      4. Implantable devices
         a. Vascular grafts
         b. Orthopedic hardware
         c. Soft tissue implants and meshes
   ii. Review situations which discourage the use of antibiotic prophylaxis:
      1. Burns
      2. Aspiration
   iii. Discuss the timing and duration of prophylactic antibiotic treatment.
   iv. Understand complications of antibiotic therapy.
   v. Summarize the use of microbiology data to tailor antibiotic therapy.
   vi. Review mechanism of action, mechanism of resistance, appropriate application, and complications of the following classes of antibiotics:
      1. Penicillins
      2. Cephalosporins
      3. Vancomycin
      4. Macrolides
      5. Metronidazole
      6. Quinolones
      7. Sulfonamides
      8. Anti-fungal agents
      9. Aminoglycosides
      10. Anti-viral agents
   vii. Demonstrate an understanding of the general pharmacology of each of the classes of antibiotics.
   viii. Describe appropriate dosing and monitoring the levels and potential toxic side effects of the different classes of antibiotics.

8. Immune Function
   a. Describe hematopoiesis.
   b. Identify the function of each of the following:
      i. T-cell
      ii. B-cell
      iii. Neutrophils

iv. Monocytes/Macrophages
v. Natural Killer Cells
vi. Eosinophils
vii. Platelets
viii. Red Blood Cells

c. Describe the development of T-cells, differentiation, tolerance and activation.
d. Describe the T-cell receptor and its role in cell mediated immunity. Identify the function of CD4 and CD8 T-cells.
e. Describe the development of B-cells, differentiation, tolerance and activation.
f. Describe the different types of antibodies, function and location.
g. Describe the Major Histocompatability Complexes and their role in immune competence, tolerance and activation.
h. Describe the function of endothelium, macrophages and neutrophils in the initiation of the immune response.
i. Describe the source, function and target of the following cytokines:
    i. IL-1, 2, 4, 6, 7
    ii. IFN, TNF
    iii. Colony stimulating factors
    iv. Nitric oxide
    v. Prostaglandins
j. Discuss the complement cascade including the classic, alternative pathways and the role of initiating the inflammatory process.
k. Discuss the inflammatory response to severe trauma, infection or burns.
l. Explain the cytokine cascade beginning with the local inflammatory reaction.
m. Describe the systemic response to inflammation, including the systemic actions of cytokines in relation to the nervous system and cardiovascular system.
n. Explain the changes of the vascular endothelium in response to systemic inflammatory response.
o. Review the metabolic and endocrine response to inflammation.
p. Summarize the recruitment and activation of immune cells to an area of inflammation or infection, including:
    i. Selectins
    ii. Beta-2 integrins
    iii. Chemotactic factors
q. Discuss the neuroendocrine response to injury, including:
    i. Afferent nerve stimulation
    ii. Hypothalamic pituitary activation
    iii. Adrenal response
    iv. Sympathetic response
r. Describe the role of nitric oxide synthase in catecholamine resistant sepsis, include discussion of therapeutic treatment with vasopressin:
    i. Intrinsic vs. inducible nitric oxide synthase
    ii. Down regulation of catecholamine receptors in sepsis
    iii. Decreased response of catecholamine receptors in sepsis
    iv. Depletion of catecholamine and vasopressin stores in sepsis

9. Wound Healing
    a. Describe the physiologic process of normal wound healing including the relationship of the following:

i. Anatomy
ii. Physiology
iii. Biology
iv. Biochemistry
v. Microbiology
vi. Immunology
vii. Molecular Biology

b. Describe the influence of the following factors on wound healing and maturation:
    i. Nutrition
    ii. Hyperglycemia
    iii. Hematologic status
    iv. Radiation
    v. Immune function
    vi. Growth factors
    vii. Oxygen free radical formation
    viii. Infection/sepsis
    ix. Chemotherapy
    x. Trauma
c. Describe the steps of wound healing:
    i. Inflammation
        1. Platelet activation
        2. Chemotaxis
        3. Transforming growth factor-Beta
        4. Platelet derived growth factor
        5. Macrophage activation
        6. Fibroblast migration
    ii. Proliferation
    iii. Remodeling
    iv. Epithelialization
    v. Contracture
d. Discuss the pathophysiology of delayed wound healing due to microbial physiology, virulence and host immune function.
e. Differentiate between the pathophysiology of thermal, chemical and electrical burns.
f. Discuss the effects of the following factors on wound healing:
    i. Wound type
    ii. Wound closure
    iii. Debridement
    iv. Dressings
g. Describe common types of chemical burns and their treatment.
h. Summarize the following treatment modalities for the closure of open wounds:
    i. Occlusive dressings
    ii. Non-occlusive dressings
    iii. Wound lavage
    iv. Alginates
    v. Anti-microbial agents
        1. Dakin's

2. Betadine
3. Acetic acid
4. Silvadene, sulfamylon

vi. Moist wound healing
vii. Vacuum assisted dressings
viii. Hyperbaric oxygen

i. Discuss the management of complicated wound healing problems:
   i. Bites
   ii. Burns
   iii. Soft tissue infections
   iv. Necrotizing fasciitis
   v. Radiation fields
   vi. Pressure sores
j. Describe the pathophysiology of gangrene, necrotizing soft tissue infections and necrotizing fasciitis.
k. Explain the appropriate selection of incision placement with respect to the following principles:
   i. Blood supply
   ii. Lines of tension
   iii. Strength
   iv. Access/Exposure
   v. Cosmesis
l. Explain the appropriate selection of surgical wound closure:
   i. Primary and delayed primary closure
   ii. Secondary closure
   iii. Skin graft, split vs. full thickness
   iv. Local flaps
   v. Microvascular flaps
   vi. Composite grafts
m. Assess the properties and uses of the different types of suture material.
n. Explain the therapeutic options for wound healing complicated by the following factors:
   i. Debilitated host
   ii. Infection
   iii. Hyperglycemia
   iv. Radiation
   v. Ischemia
o. Identify resources needed to assist wound healing outside the hospital.
p. Describe the principles for prevention of pressure ulcerations and the different relief devices and beds used to prevent and treat pressure ulcerations.

10. Statistics
    a. Define a Type I error.
    b. Define a Type II error.
    c. Describe the null hypothesis.
    d. Describe the p value and confidence intervals.
    e. Define variance.
    f. Describe the following terms:
       i. Mode

ii. Median
iii. Mean

g. Describe the differences between common trials and studies:
    i. Randomized controlled trial
    ii. Double blind controlled trial
    iii. Cohort study
    iv. Case-control study
    v. Meta-analysis
h. Describe the differences between common quantitative variable tests:
    i. Student's T test
    ii. Paired T test
    iii. Anova
i. Describe the difference between common qualitative variable tests:
    i. Nonparametric statistics
    ii. Chi-squared test
    iii. Kaplan-Meyer
j. Define relative risk.
k. Define power of a test.
l. Define prevalence.
m. Define incidence.
n. Define sensitivity.
o. Define specificity.
p. Define positive predictive value.
q. Define negative predictive value.
r. Define accuracy.

11. Burns
    a. Describe the layers of skin.
    b. Define burn classification: degree and description.
    c. Describe the method for assessing percentage body surface area burned. Include the difference between adults and children.
    d. Outline admission criteria for burn victims.
    e. Describe risk factors for inhalation injury:
        i. EtOH consumption
        ii. Closed space
        iii. Delayed extrication
        iv. Extremes of age
    f. Describe the finding associated with inhalation injury:
        i. Carbonaceous sputum
        ii. Hoarseness/stridor
        iii. Singed facial hair
        iv. Difficulty maintaining oxygen saturation
        v. Methemoglobin
    g. Outline risk factors for child abuse:
        i. Delayed presentation
        ii. Conflicting history
        iii. Previous injuries
        iv. Sharply demarcated edges
        v. Uniform depth

vi. Absence of splash marks
vii. Socking/glove distribution

h. Define the Parkland formula.
i. Describe methods for evaluating response to resuscitation.
j. Describe indications for and the procedure for performing escharotomy:
    i. Circumferential burn
    ii. Low temperature
    iii. Weak pulse
    iv. Decreased sensation and neurologic function
    v. Difficulty ventilating pt. with chest/torso burns
k. Describe the indications for and the procedure for performing fasciotomy.
l. Describe the pathophysiologic differences and treatment of atypical burns:
    i. Acid/Alkali burns
    ii. Hydrofluoric acid
    iii. Powder burns
    iv. Electric burns
    v. Electrocution
    vi. Radiation
m. Describe the important renal protective adjuncts for treatment of patients with electrocution, deep burns with significant muscle involvement or compartment syndrome.
n. Outline the metabolic changes that occur in severe burns, and how to best meet the nutritional requirements of burn victims.
o. Describe the tenets of wound management.
p. Outline the differences between full thickness and split thickness skin grafts, the relative indications and potential benefit of each.
q. Describe the indication for each of the following skin substitutes:
    i. Homografts
    ii. Xenografts
    iii. Dermal substitutes
r. Describe the common reasons for graft loss.
s. Describe the common complications for STSG and FTSG.
    i. Contraction
    ii. Hypopigmentation
    iii. Ability to regenerate/repair
t. Outline the different antimicrobial topical treatments for burns including their indications and limitations:
    i. Silvadene
    ii. Silver nitrate
    iii. Sulfamylon
    iv. Actigal
u. Describe the common organisms responsible for wound infection in burn victims.
v. Outline the common post-burn complications:
    i. Pneumonia
    ii. Wound infection
    iii. Seizures
    iv. Peripheral neuropathy

v. Ectopia
vi. Corneal burn/abrasion
vii. Symblepharon
viii. Heterotopic ossification of tendons
ix. Wound contracture
x. Curling's ulcer
xi. Marjolin's ulcer
xii. Hypertrophic scar

w. Radiation Exposure
    i. Understand the exposure necessary to cause acute radiation syndrome.
    ii. Describe the components or radiation exposure: whole body, penetration, duration
    iii. Describe the three classic components of acute radiation syndrome
        1. Bone marrow
        2. Gastrointestinal
        3. Neurologic
    iv. Describe the four stages of acute radiation syndrome
        1. Prodrome
        2. Latent Stage
        3. Manifest Stage
        4. Recovery or death Stage
    v. Describe manifestations of Cutaneous Radiation Syndrome

12. Basic Disaster Management
    a. Define divisions of "all-hazards": Man-made/Natural.
    b. Describe basic differences required for disaster preparedness required to prepare for man-made disaster as compared to natural disaster.
    c. Understand concept: capabilities of resources.
    d. Define mass casualty concept and how this relates to utilization of health resources.
    e. Describe levels of healthcare delivery as it relates to mass casualty incident:
        i. EMS and community
        ii. Hospitals and other receiving facilities
        iii. Regional: tertiary care facilities
        iv. National: Government agencies, CDC, military
    f. Define DISASTER paradigm and Assessment checklist.
    g. Describe Hospital, County, State and Federal detection and awareness strategy.
    h. Describe Hospital Incident Command Operations as it relates to the type of MCI and number of casualties.
    i. Describe Hospital Safety and Security operations as it relates to the type of MCI and number of casualties.
    j. Describe assessment of hazards as it relates to the type of MCI and number of casualties.
    k. Describe the different levels of personal protective wear and indications for each level.

l. Recognize need for Local-regional, State, Federal and military support as it relates to the type of MCI and number of casualties.
m. Define MASS triage system for disaster triage.
n. Define ID-ME system for patient triage.
o. Describe hospital mechanism for moving, housing and evacuation of patients.
p. Define implications and mechanisms to assist in disaster recovery: re-establishment of local health care and individual crisis and management counseling.

Patient Care

1. Physiology
    a. Manage patients with alterations in physiologic function secondary to trauma, surgery, infection or burn.
    b. Adapt patient care plans to reflect changes in physiologic function as related to geriatric, pediatric, immunosuppressed and pregnant patients.
    c. Utilize invasive monitoring to measure alterations in patient physiologic function.
    d. Adjust patient care plans to reflect measured responses and adaptation to interventions performed
    e. Implement early appropriate nutritional supplementation.
2. Fluid and Electrolyte Homeostasis
    a. Use vital signs, fluid balance data as general measures of fluid homeostasis.
    b. Use appropriate invasive monitoring to evaluate patient fluid balance.
    c. Estimate patient fluid requirements based on type of injuries, surgery and physiologic state.
    d. Provide fluid and electrolyte replacement therapy to patients based on type of injuries, surgery or physiologic state.
    e. Coordinate orders for fluid balance with enteral/parenteral nutrition requirements.
    f. Appropriately modify fluid and electrolyte replacement therapy for geriatric, pediatric and pregnant patients.
3. Acid-Base Homeostasis
    a. Diagnose underlying cause of acid-base disturbances in patients.
    b. Identify surgical causes of acid-base derangements and determine appropriate care plan for surgical emergencies.
    c. Identify medical causes of acid-base derangements and determine appropriate supportive care.
    d. Modify care plan to appropriately treat acid-base disturbances
    e. Manage multiple system abnormalities and appropriately coordinate pulmonary support, renal support and fluid homeostasis to achieve acid-base homeostasis.
4. Metabolism
    a. Calculate daily energy requirements for critically-ill patients.
    b. Utilize metabolic cart and indirect calorimetry to calculate metabolic needs.
    c. Calculate nitrogen balance in these patients.

d. Derive appropriate nutritional care plans for critically-ill patients.
e. Make appropriate calculations for parenteral nutrition, enteral nutrition and supplementation.
f. Use nutritional markers to evaluate appropriate response to nutritional supplementation.

5. Nutrition
    a. Perform nutritional assessment of hospitalized patients.
    b. Select appropriate methods of nutritional support.
    c. Calculate the nutritional requirements for patients.
    d. Insert enteral and parenteral tubes and lines.
    e. Provide appropriate monitoring of nutritional goals.
    f. Recognize and treat complications of enteral and parenteral nutrition.
6. Hematology
    a. Employ a cost-effective screening strategy to identify surgical patients at risk for coagulopathy.
    b. Evaluate patients with known coagulopathy.
    c. Devise preoperative, intraoperative and post-operative management plans for patients with known coagulopathies.
    d. Diagnose and treat unexpected intra-operative and post-operative hemorrhage.
    e. Recognize and treat transfusion reactions.
    f. Discuss with family and patients the risks, benefits and alternatives to blood component transfusion.
    g. Identify patients with risk factors for development of deep venous thrombosis.
    h. Develop a cost-effective strategy to prevent the development of venous thrombosis.
    i. Discuss long term management of deep venous thrombosis and other resultant complications.
    j. Manage surgical patients with requirements for chronic anticoagulation therapy.
    k. Manage surgical patients with hemoglobinopathies.
    l. Manage surgical patients on fibrinolytic therapy.
7. Surgical Infections
    a. Appropriately diagnose and treat common infections seen in surgical patients.
    b. Make appropriate and timely diagnosis for simple and complex infections in the surgical patient; alter therapy as indicated by the clinical response. Tailor antibiotic therapy according to susceptibility panels.
    c. Competently diagnose and treat necrotizing fasciitis.
    d. Prepare patients for elective surgery with the appropriate antibiotic prophylaxis.
    e. Coordinate the treatment of aggressive soft tissue infections, including:
    f. Early operative debridement and frequent re-debridement as necessary
    g. Urinary and fecal diversions as necessary
    h. Antibiotic and wound care management
    i. Appropriate nutritional support
    j. Identify, diagnosis, and treat implantable device infections.

k. Practice effective use of universal precautions, including meticulous hand washing to prevent the transmission of infection.

8. Immune Function
    a. Provide the therapeutic rationale for modifying the inflammatory response with nonsteroidal anti-inflammatory agents and steroids.
    b. Debride and clean surgical wounds to eliminate chronic sources of sustained inflammation.
    c. Use catecholamine pressor agents with an understanding of the pathophysiology underlying the septic state.
9. Wound Healing
    a. Provide basic wound care.
    b. Provide care for complex wounds including:
        i. Management of hemorrhage
        ii. Acute pain control
        iii. Operative Exploration
        iv. Debridement
        v. Acute closure
        vi. Secondary reconstruction
    c. Evaluate progress of wound healing.
    d. Apply all types of dressings and casts.
    e. Remove casts and complex dressings.
    f. Debride complex wounds.
    g. Manage wound care of complex wounds.
    h. Perform split thickness and full thickness skin grafts.
    i. Manage wound complications such as: dehiscence, wound infections and incisional hernias.
10. Statistics
    a. Review literature and understand basic evaluation of data.
    b. Use medical literature to develop evidence based patient care.
11. Burns
    a. Manage patients with burns.
    b. Use Parkland formula to initiate fluid resuscitation.
    c. Evaluate the need for intubation in burn patients.
    d. Treat wounds with early debridement and appropriate topical care.
    e. Outline procedure for debridement and performing STSG and FTSG.
    f. Outline important differences in treatment of atypical burns.
    g. Describe the challenges associated with diagnosing acute radiation syndrome.
    h. Describe the Andrews Lymphocyte Nomogram
    i. Outline other manifestations of acute radiation exposure.
12. Basic Disaster Management
    a. Describe Hospital Policy for activation of MCI.
    b. Describe Department of Surgery Disaster Plan and calling tree.
    c. Have practical understanding or Surgery role in hospital MCI.

d. Understand practical application of ID-ME triage.
e. Understand practical limitations of operating room, critical care bed space, nursing and technical support of MUSC disaster surge capacities.

13. Procedures
    a. Demonstrate competence in the following procedures:
        i. Placement of intravenous catheter
        ii. Placement of nasogastric tube
        iii. Placement of urinary catheter
        iv. Placement of central venous catheter
        v. Placement of thoracostomy tube
        vi. Placement of pulmonary artery catheter
        vii. Placement of arterial lines.
        viii. Bronchoscopy
        ix. Endoscopy
        x. Endoscopic placement of enteral access
    b. Demonstrate competence in the following operative procedures
        i. Exploratory laparotomy/laparoscopy
        ii. Stomach or bowel resection and anastomosis
        iii. Repair/resection of liver, spleen, kidney,
        iv. bladder repair
        v. Appendectomy
        vi. Cholecystectomy
        vii. Debridement/resection pancreas
        viii. Repair of abdominal wall hernias
        ix. Repair of diaphragmatic hernias
        x. Pericardial window
        xi. Thoracotomy with repair/ligation of blood vessels, heart, or lung parenchyma
        xii. Repair or ligation of major arteries or veins.

Practice Based Learning

1. Understand experience with patients. Evaluate performance of resuscitation of trauma and critically injured patients within the framework of basic physiologic principles.
2. Use the library and internet resources to continually update and assimilate new research regarding the physiologic response to surgery, stress, and infection in trauma and critically injured patients.
3. Understand experience with patients. Evaluate performance of fluid and electrolyte resuscitation of trauma and critically injured surgical patients within the framework of basic physiologic principles.
4. Use the library and internet resources to continually update and assimilate new research regarding fluid and electrolyte replacement in trauma and critically injured surgical patients.

Systems Based Practice

1. Lead daily inpatient rounds on the surgical critical care service including the entire multidisciplinary critical care team.
2. Develop daily management plans for patients including coordination of care with other medical specialties involved in patient management.
3. Oversee the trauma team during emergency department evaluation of emergent trauma patients
4. Supervise resident staff in the evaluation and initial management of emergency surgery patients.
5. Discuss the role of each of the following professions in management of the critically ill or injured patient.
    a. Nursing
    b. Respiratory Therapy
    c. Pharmacology
    d. Dietician
    e. Physical Therapy
    f. Occupational Therapy
    g. Speech Therapy
    h. Chaplain
    i. Social Work
    j. Radiology technology
6. Discuss the role of each of the following medical specialties in management of the critically ill or injured patient.
    a. Orthopedic Surgery
    b. Neurosurgery
    c. Cardiology
    d. Pulmonology
    e. Geriatrics
    f. Palliative Care
    g. Plastic Surgery
    h. Facial Reconstructive Surgery
    i. Anesthesiology
    j. Radiology
7. Discuss physician billing and coding as it applies to critically ill and injured patients.
8. Discuss the principles of hospital billing and coding as it applies to documentation of care in the intensive care unit

Professionalism

1. Demonstrate honesty in all communications
2. Demonstrate respect for all members of the critical care team including both patient care providers and support personnel
3. Demonstrate a professional demeanor in all communications with patients and their family

4. Maintain professional attire at all times.
5. Complete medical records in a timely, and accurate, fashion.

Interpersonal and Communication Skills

1. Actively and effectively teach residents and medical students assigned to the surgical critical care service, trauma service, and night emergency/trauma service.
2. Formulate diagnostic and treatment plans for critically ill and injured patients and communicate directly to the attending surgeon and other members of the multidisciplinary critical care team.