The University of Wisconsin
Critical Care Anesthesiology Reading List

Micah T. Long, MD  Last Updated March 8, 2023

*Recommendations are not endorsements

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</table>
Section 1: Cardiovascular

1. PE & DVTs:
   a. Pulmonary Embolism
      iii. Management of Acute PE, JAMA 2020 Clinical Guidelines Synopsis:
           https://jamanetwork.com/journals/jama/fullarticle/2769249
      iv. Management of PE, A short ACC Review, 2020:
      v. Initial Anticoagulation for PE: Br J Clin Pharmacol 2017:
           https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5651323/
      vi. PEITHO Trial, Fibrinolysis for Intermediate Risk PE, NEJM 2014:
      vii. Moppett trial follow-up, half-dose alteplase, CCM 2018:
      viii. Catheter Directed Thrombolysis for Intermediate Risk PE: Ann ATS 2018:
            https://www.ncbi.nlm.nih.gov/books/NBK536918/
      x. Management of high risk PE, narrative review, JICM 2018:
      xi. Thrombolysis for PE & Risk of Mortality/Bleed/ICH: JAMA 2014:
      xiii. Catheter-therapies for PE, Clinic Chest Med 2018:
   b. VTE
      i. Antithrombotic Therapy for VTE Disease: Second Update of the CHEST Guideline and
      ii. DVTs, JAMA 2018 Review Dx and Tx: https://pubmed.ncbi.nlm.nih.gov/30326130/

2. Pulm HTN and the RV
   a. Management of acute RV failure in the ICU, Ann ATS 2014:
   b. ICU Management of severe pHTN and RV failure, AJRCCM 2011:
   c. The Challenge of Managing an RV infarct, Ero Heart JACVC 2013:
   d. Pulm Vasodilators and Anesthesia, Anesthesiol Clin 2017:
   e. Other
      i. DAH within cardiac disease, Lung 2021: https://pubmed.ncbi.nlm.nih.gov/33709230/
3. PVD – aneurisms, dissections
   a. Preoperative Assessment for Vasc Surg, Anesthesiol Clin 2022:
   b. Critical Care after Vascular Surgery, Anesthesiol Clin 2022:
   c. Thoracic Aortic Aneurysm: A clinical review: Cardiol Clin 2021:
      https://pubmed.ncbi.nlm.nih.gov/34686263/ (This focuses on preoperative assessment, timing of intervention and medical history/factors)
   g. Neuroprotection in the OR and spinal cord ischemia, endovascular, J Vasc Surg 2016:

4. Rhythm/arrhythmias and antiarrhythmic agents
   b. Tx Strategies for new AFib in the ICU, Crit Care 2021:

5. Shock States and Vasoactives
   a. Reviews:
      i. Pathophys of Septic Shock, Crit Care Clin 2018:
      iv. Cardiac function & dysfunction in sepsis, Clin Chest Med 2016:
      v. After Cardiac Surgery / Cardiac Bypass: Pick your favorite --
   b. Fluid Considerations:
      i. Historical: Early Goal Directed Therapy, NEJM 2001:
The UW Critical Care Reading List

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v. First 24h restrictive or liberal fluid strategy, NEJM 2023: https://pubmed.ncbi.nlm.nih.gov/36688507/

c. Lactate & Capillary Refill:

d. Vasoactive Therapy
   ii. Decatecholaminization during Sepsis, Crit Care 2016 editorial: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5048664/
   v. Vaso vs. NE in septic shock: VANISH trial https://jamanetwork.com/journals/jama/fullarticle/2540403

e. MAP Goals
   i. MAP 63 vs. 77 after cardiac arrest (and comatose), NEJM 2022: https://pubmed.ncbi.nlm.nih.gov/36027564/
   v. MAP Goal Selection in the ICU, systematic review & meta-analysis, CCM 2023: https://pubmed.ncbi.nlm.nih.gov/36661452/

f. Other Agents (this is not advocating for these drugs):

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6. Structural: Pericardial, Valvular including HOCM, ASH, IHSS, oxygen supply and demand in the heart, acquired ASD and VSD, cardiomyopathies, non-infectious myocarditis, papillary muscle dysfunction, myocardial stunning, Takotsubo’s

7. Pericardial effusion, pericarditis and tamponade

8. Devices:
   a. ECMO-VA [See VV ECMO in Resp; See ELSO Site & ELSO Redbook]
   b. VADs: LVAD or RVAD, open or percutaneous

c. **Pacer/Defibrillators**: AICDs, External defibrillators, transthoracic, Transvenous / epicardial

d. **IABP**
e. **IVC Filters** (*not in CCM outline*)

9. **Postop Management Topics**

10. **Transplant – rejection and complications**

11. **Infection/inflammation – endo-, myo-, pericarditis**

12. **CAD, MI, HTN; CHF- LV, diastolic/systolic, RV; CHD in adults – Eisenmenger, TOF, shunts**


13. Trauma – contusion, tamponade, ATLS

14. Pulsus paradoxus

15. DO2 (systematic) and VO2 (oxygen supply and demand)

16. Diagnostics
   a. Physical Exam
      i. See above in Andromeda Shock & Septic Shock section.
   b. Art line / BP, CO monitors, CVP, EKG, PPV, SVV, other
      i. Hemodynamic Monitoring by Dr. Pinsky, preeminent in this arena, Crit Care 2022: https://pubmed.ncbi.nlm.nih.gov/36171594/
      ii. Please read Miller’s Anesthesiology Chapter on Hemodynamic Monitoring.
   d. Imaging: CT, MRI, interventional imaging, nuclear imaging, TTE, TEE, bedside ultrasound
      i. See TTE / Echo below.

17. Management
   a. Antihypertensives
   b. Antidysrhythmics
   c. Pericardiocentesis
Section 2: Respiratory

1. **ARDS**
   a. **Reviews:**
   b. **Select Therapies for ARDS:**
      iii. Pharmacologic Tx in ARDS, Crit Care Clin 2021: [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8449143/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8449143/)
   c. **Prone:**
      ii. Proning in ARDS, Chest 2017: [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6026253/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6026253/)
      iii. Proning in ARDS, who/how/whom, ICM 2020: [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7652705/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7652705/)
   d. **Paralysis**
   e. **Steroids**
iii. Steroids in ARDS: Meduri round 2: CCM 2018:  
https://pubmed.ncbi.nlm.nih.gov/29432350/  with good editorial review here:  

https://pubmed.ncbi.nlm.nih.gov/32043986/

v. Steroids in ARDS: Pharm Principles surrounding prolonged therapy in ARDS, ICM 2020:  

f. Fluids

i. Fluids in ARDS (and PAC catheters), by CVP goal (dry is better), FACTT Trail, NEJM, 2000’s:  

ii. Fluids in ARDS: Which Management: ICM review 2020:  

g. Re-examining Permissive Hypercapnea in ARDS, Narrative Review in Chest 2018:  

h. Analgesia and Sedation for ARDS: ICM 2020:  

2. Ventilator: Tidal Volumes, Power, PEEP, VILI, FiO2

a. VILI

i. The ARMA Trial (low or high Vt): NEJM 2000  
   1. Possibly not the most ethical trial, NEJM 2003:  

ii. Tidal Volume Selection Review: AJRCCM 2017:  

iii. Opening Pressures & Atelectotrauma in ARDS: ICM 2017  

iv. Driving Pressure and Survival in ARDS, NEJM 2015:  
This is my favorite article in all of ventilation & ARDS!!  

v. Driving Pressure for ARDS: Anesthesiology 2020  
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7449829/

vi. VILI Review, Crit Care Clin 2018:  
   1. Mechanical Power and VILI: Anesthesiology 2016:  
   2. Mechanical Power and VILI: ICM 2016:  
   3. VILI Review: NEJM 2013  

vii. How to use transpleural gradients / esophageal manometry: EPVent2 2014:  

viii. Clinical Strategies for implanting lung and diaphragm protective ventilation: Insufficient and Excessive Effort, ICM 2020 narrative rview:  

b. FiO2 / Oxygenation / Saturation Goals

i. Dangers of Hyperoxia, Crit Care 2021:  

ii. Clinical Implications of Hyperoxia, Int Anesth Clinics 2018:  

iii. Hyperoxia and Mortality: BJA 2020:  


c. PEEP
   vii. Personalizing Mechanical Ventilation according to physiologic parameters to stabilize alveoli and minimize VILI [another “how to optimize PEEP” manuscript]. Intensive Care Med Exp, 2017: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5289131/

3. Ventilator Modes & Waveforms
   g. APRV – a review and waveforms included, Resp Care 2016: https://pubmed.ncbi.nlm.nih.gov/27235312/

4. Non-invasive Modes

5. Pulmonary Edema; Pleural effusion
6. Infections: Abx, antivirals, antifungals
   a. Pneumonia (CAP, HAP, VAP)
   i. New aspects in PNA Tx, Crit Care 2016: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5045574/
   l. Empyema, abscess (see pleural effusion)
   m. Mediastinitis
   n. Tracheobronchitis
   o. Pneumovax / vaccination

7. VV ECMO: See the ELSO Site and ELSO Redbook
   c. ECMO for Severe ARDS, ICM 2020: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7605473/
   d. ELSO VV ECMO Guideline 2021 https://journals.lww.com/asaiojournal/Fulltext/2021/06000/Management_of_Adult_Patients_Supported_with_1.aspx
   e. ECMO for ARDS, the CESAR Trial: Lancet 2009: https://pubmed.ncbi.nlm.nih.gov/19762075/
   f. ECMO For ARDS, the EOLIA Trial: NEJM 2018: https://pubmed.ncbi.nlm.nih.gov/29791822/
   g. Combined CESAR, EOLIA (more), meta-analysis, ICM 2020: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7537368/
   h. Ventilation While on VV-ECMO:
ii. Ventilation on ECMO – Super protect – Con. Pro/Con Editorials in CCM, 2019
iii. UltraProtective & BioTrauma, Pro, 2019 CCM:
iv. Ultraprotective & BioTrauma, Con, 2022 Crit Care:
l. Bleeding & Thrombosis with ECMO, Semin Thromb Hemost 2018:
m. Algorithmic approach to Hypoxia on ECMO: Intensive Care Medicine 2016, a must read
n. Weaning from VV ECMO, JTD 2018: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5911556/

8. Spontaneous breathing trials / Cuff Leak
   a. Clinical Practice Guideline for Ventilator Weaning, AJRCCM 2017:
      https://pubmed.ncbi.nlm.nih.gov/27762595/ This includes a guide and figure towards the management
      of the patient without a cuff leak.

9. Differential lung ventilation, prone positioning

10. Aspiration

11. Embolic disorders – air, fat, thromboembolic, other
    a. See CV – PE & RV failure portions

12. Inflammatory & autoimmune diseases
    b. Diffuse Alveolar Hemorrhage, a review, AJR AM J R 2021:
       i. DAH in cardiac disease: https://pubmed.ncbi.nlm.nih.gov/33709230/
    c. Life-threatening Hemoptysis, Seminars in Resp Crit Care Med 2021:

13. Lung transplant
    a. Lung Tx – Afib Aflutter guide, Heart Lung Circ 2020:
    c. Hyperammonemina after Lung Transplant, Chen Transplantation 2016 (see Non-hepatic

14. Airway disruption: tracheal, PTX, volutrauma, BPF
    a. Management: Bronchopleural, bronchocutaneous fistula management

15. Lung and chest wall tumors

16. Chest trauma (contusion, flail)
       part of ABA content outline)
17. General Topics: Airway disease – obstructive, reactive, restrictive; Pulm mechanics and WOB; Resp Failure; Hypoxia (acute/chronic), hypercapnia (acute, chronic); and V/Q problems; OSA – central and obstructive sleep apnea; Drowning – fresh and saltwater; PFTs, pulm mechanics; Sleep Studies; Imaging: CXR, CT/MRI, nuclear studies, US
   a. See Miller Chapter: Respiratory Physiology
   b. TRALI / TACO – see hematology / transfusion

18. ABG, capnography, pulse ox
   b. See Miller Chapter: Respiratory Physiology

19. Thoracentesis & chest tubes; bronchoscopy, laryngoscopy.

20. Pulmonary meds
   a. Dornase Alfa etc
   b. RT Therapies (see table at bottom)

21. Other Recommended Literature:
24. Perioperative Lung Protective Ventilation, BMJ 2018:
    https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6889848/
25. Driving Pressure in Thoracic Surgery: Anesthesiology 2019 RCT:
27. Optimal PEEP in bariatric OR: Anesthesia 2020 (look at last tables):
## Respiratory Therapy Treatments

### Airway Clearance

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<th>Therapy</th>
<th>Indication</th>
<th>Contraindication</th>
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<tr>
<td>MetaNeb</td>
<td>Excessive or retained secretion clearance and/or Atelectasis</td>
<td>1. Untreated tension pneumothorax or persistent air leak&lt;br&gt;2. Tracheoesophageal surgery&lt;br&gt;3. Active hemoptysis</td>
</tr>
<tr>
<td></td>
<td>Delivers 3 therapies in one-aerosol, secretion clearance and lung expansion in line with the ventilator</td>
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<tr>
<td>Cough Assist Machine (In-Exsufflator)</td>
<td>Assist with clearing secretions by delivering a positive pressure followed by a negative pressure to the airways</td>
<td>1. Known pneumothorax&lt;br&gt;2. Bullous emphysema</td>
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<td></td>
<td>Patient disconnected from the ventilator to receive therapy</td>
<td></td>
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<tr>
<td>High Frequency Chest Compression Vest Treatment (HFCC)</td>
<td>Mobilize respiratory tract secretions from lung lobes or segments into the central airways</td>
<td>1. Known pneumothorax&lt;br&gt;2. Fractured ribs</td>
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<tr>
<td>Positive Expiratory Pressure (PEP)</td>
<td>Mobilizes secretions toward the large airways to be cleared more easily by coughing</td>
<td>1. Untreated/Known pneumothorax&lt;br&gt;2. Recent facial, oral, skull surgery or trauma&lt;br&gt;3. Tympanic membrane rupture</td>
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<td>(For non-vented patients only)</td>
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<tr>
<td>Aerobika</td>
<td>Loosen mucus in the airway so the patient can expectorate more easily. Patient unable to create an expiratory flow of 10 liters per minute may not be able to generate enough force to preform adequate</td>
<td>1. Untreated/Known pneumothorax&lt;br&gt;2. Active hemoptysis&lt;br&gt;3. Tympanic membrane rupture</td>
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<td>(For non-vented patients only)</td>
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### Volume Expansion

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<th>Therapy</th>
<th>Indication</th>
<th>Contraindication</th>
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<tbody>
<tr>
<td>Constant Positive Airway Pressure (CPAP) Continuous and intermittent</td>
<td>Spontaneously breathing patients that provide positive pressure to the airways for: Hypoxemia, Pulmonary edema, and Obstructive Sleep Apnea</td>
<td>1. Recent facial, oral or skull surgery/trauma&lt;br&gt;2. Epistaxis&lt;br&gt;3. Esophageal surgery&lt;br&gt;4. Active hemoptysis&lt;br&gt;5. Untreated pneumothorax&lt;br&gt;6. Tympanic membrane rupture</td>
</tr>
<tr>
<td>Cough and Deep Breathing/Incentive Spirometer</td>
<td>Removal of bronchial secretions via coughing/deep breathing</td>
<td>N/A</td>
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Section 3: Procedures, Airways, Codes

Includes Intubation, POCUS, Codes, Line Placement & Emergencies

1. Intubations
   a. Overall reviews of intubation in the ICU
      i. ICU Airway Management, 2018 Crit Care Clin: [Link]
      ii. A review of emergency airway management out of the OR, Anesth Analg 2021: [Link]
      iii. Endotracheal intubation in the ICU, Crit Care 2015: [Link]
      iv. Tracheal intubation in the critically ill, systematic review, Crit Care 2018: [Link]
      v. Intubation and Outcomes in the ICU, the INTUBE Study, JAMA 2021: [Link]
      vi. Risks of severe collapse after intubation in the ICU, Crit Care 2015: [Link]
      vii. Risk Factors for hemodynamic collapse (again), Annals ATS 2020: [Link]
      viii. Peri-intubation CV Collapse in ICU Intubations (round 3), AJRCCM 2022: [Link]
   b. Approach
      i. VL vs. DL is more likely driven by trainee level and prior experience than device specific, so I am avoiding the topic here. Please consider reading: Trainee Level and Success of intubation, J Clin Anesth 2016: [Link]
      ii. Bougie Trial, JAMA 2021: [Link]
      iv. Awake FBO in the OR for anticipated difficult airways – a review and meta-analysis of RCTs, Anesth Analg 2019: [Link]
      vi. Awake VL vs. Awake FBO, Curr Opin Anaesthesiol, 2019: [Link]
      vii. Awake Airway – Dexmed still causes upper airway collapse (healthy volunteers), nonblinded crossover versus propofol, Anesthesiology 2019: [Link]
c. Intubation Drugs:
   i. The INTUBE study (above), looking at CV collapse & Propofol, AJRCCM 2022:
   ii. Etomidate Debate: is etomidate safe in unstable critically ill patients? Crit Care 2012:
   vi. Prop, Keta, Etom in the ICU, Crit Care Explor 2021:
   vii. Avoid or use NMBs for intubation? Cochrane Review 2017:
        used throughout the article (0.6 vs. 1.2): https://pubmed.ncbi.nlm.nih.gov/26512948/
   ix. The limits of succinylcholine for critically ill patients: Anesth Analg 2012:
   x. Succinylcholine: Should it be used anymore? Transl Perioper Pain Med 2019 – obscure
      journal, but reviews considerations: https://pubmed.ncbi.nlm.nih.gov/33834087/
   xi. Roc & Succ (and more): IBW or TBW? Dosing of NM Blocking agents in patients with
      obesity, narrative review, Anaesth Intensive Care 2021:
   xii. Sugammadex: Special considerations and complications after administration: BMC

d. Airway Edema / Cuff Leak
   i. Steroids for Edema, BMJ 2008 meta-analysis:
   ii. Clinical Practice Guideline for Ventilator Weaning, AJRCCM 2017:
       https://pubmed.ncbi.nlm.nih.gov/27762595/ This includes a guide and figure towards the
       management of the patient without a cuff leak.

2. Tracheostomy
   a. Instead of citing all the trials, the following link is a recent systematic review and meta-analysis.
      If you’d like to see each trial (e.g. TracMan from JAMA), go through these citations:
      Bayesian analysis comparing early/late approaches, BJA 2022:
   b. I enjoy the unofficial (non-peer reviewed) guidance for Percutaneous tracheostomy placement
      at https://resusreview.com/2015/perc-trach-tutorial/

3. Codes & Cardiac Arrest
guidelines

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b. E-CPR
         With follow-up to 180 day survival: https://pubmed.ncbi.nlm.nih.gov/36303227/


g. Cardiac Advanced Life Support: 

4. Rescue Echo: Note, minimal echo-related content is in the CCM Content Outline (for the exam). I strongly recommend the Utah Anesthesiology Website Lecture Series and Resources. See a full guide at bottom. https://echo.anesthesiology.med.utah.edu/pocus-content/


5. Central Access and Line Placement: including catheter / bundles
The UW Critical Care Reading List

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6. Chest Tubes

7. Other
   c. Disaster triage
   d. Biologic/chem/nuclear exposures
   e. ACLS, ATLS: Please see accordant guidelines and resources.
   f. Anaphylaxis
Echo Self-Directed Lecture Series,
From the “Home Base” of the Utah Department of Anesthesiology

Introductory Lectures:
1. “Why Focused Cardiac Ultrasound”?
2. What is “FoCUS”?
3. Anatomy Review
   a. Optional: I recommend you print something out to jot notes on while you watch, or just to see things in two ways. Here is a wonderful PPT (attached as a PDF) reviewing what the basic views are with anatomy printed, and what you look for in each view.
   b. Optional: Another site that has the basic views with short video clips, and really good Netter style anatomy right next to the echo image – by “CriticalEcho.com”
4. Basic Concepts of Ultrasound – I don’t love setting these up too early, because it always feels like it gets into the weeds. But this is short and gets into how to review basic settings and use a probe. Worth it.
5. TeachingMedicine.com – One of many resources to quiz yourself.

Intermediate Lectures
6. FoCUS “How to”
7. Function Videos:
   a. LV Function
   b. RV Function
8. Case Review: Here – Focus to the Rescue
9. Then, go back to the Teaching Medicine Course and review the Module: “TTE Shock Assessment”
10. I’d recommend a TEE-heavy lecture on Hypovolemia vs. Vasoplegia.

Advanced Echo:
11. Basic Valves
12. Wall Motion Abnormalities – is your patient having an MI?
13. Other excellent cases are here – mostly TEE; my favorites:
   a. PE https://echo.anesthesia.med.utah.edu/rescue-tee-part-ii-dynamic-obstruction-pulmonary-embolism/
   b. Failure and Tamponade https://echo.anesthesia.med.utah.edu/rescue-tee-iii-tamponade-ventricular-failure/

Chest / Lung Ultrasound
14. Introduction and Pneumothorax
   a. If you prefer learning by reading, this is a great review: https://pubmed.ncbi.nlm.nih.gov/29411300/
15. Fluid – Pulmonary Edema (crucial) and Pleural Effusions.
1. **Brain Death**: end-of-life and futility; Consent, living will, DPOA, surrogate
   c. Neuro Outcome Prediction Models after cardiac arrest – scores/actual outcomes are reviewed, Crit Care 2022: [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9741710/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9741710/)

2. **Stroke** – hemorrhagic & ischemic, hypertensive; hemorrhagic conversion
      i. Follow-up, maybe this AHA guidance is too restrictive, and 90-days is enough, JAMA Surgery, 2023: [https://pubmed.ncbi.nlm.nih.gov/35767247/](https://pubmed.ncbi.nlm.nih.gov/35767247/)

3. **Anoxic Brain Injury**

4. **SAH, subdural, epidural hematoma**

5. **Vascular malformations (AVMs, Aneurisms)**

6. **TBI** – closed and open, SAH, Subdural/Epidural Hematoma.

7. Masses and intracranial compliance
   a. Cerebral Blood Flow
   b. ICP therapies / Cooling after Arrest
   c. Neuroprotectants, Steroids
   d. Vasoactive drugs and CBF

8. Infection: abscess, encephalitis, meningitis/ventriculitis
   a. Meningitis, Royal College of Physicians Management Update, 2022: https://www.rcpjournals.org/content/clinmedicine/22/5/396


10. Seizures, Status Epilepticus including AEMs

11. Spinal Cord Injury

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12. AMS, Encephalopathy, coma, delirium, hallucinations, hypoxic/metabolic encephalopathy, CAM-ICU and RASS scoring systems; Pain/sedation, analgesia, regional, sedatives/hypnotics, Antipsychotics; daily holiday; delirium assessments with CAM/RASS [from BUNDLES section of CCM Outline]

   a. Sedation

   b. Delirium:

   c. Scores / Assessment and Nursing Tools, Mobility and the like:
      (This followed Ely NEJM 1996 SBT, and Kress NEJM 2000 SAT trials).

13. Alcohol Withdrawal

14. Degenerative disease (alzheimer’s, Parkinson’s)
15. NM Disorders
16. GBS, Myasthenia gravis, myopathy


17. Demyelinating disease; polyneuropathy / myopathy in the ICU – see endocrine for steroid-weakness

18. Pituitary – acromegaly / sheehan's/pituitary infarct - see endocrine section

19. Depression, anx, PTSD

20. Diagnostics:
   b. Angiography, Other imaging (CT, CTA, MRI, MRA); CBF / nuc med studies; Transcranial doppler
   c. EEG, Evoked potential, Nerve conduction, EMG
      i. Chapter: Lee & Menon, Neuromonitoring in Anaesthesia and Intensive Care Medicine, 2005 (it’s fantastic), Chapter 6, p158+
      ii. EVD Cheat Sheet (ICU One Pager) https://static1.squarespace.com/static/5e6d5df1ff954d5b7b139463/t/600f1147f6c92c18b41ae252/1611600200433/ICU_one_pager_EVD_V11.pdf
      iv. EEG Primer for Acute Care Physicians (Prior Fellow recommended) https://journals.sagepub.com/doi/pdf/10.1177/1751143720949454
   d. Jugular venous saturation and Microdialysis

21. Management:
   a. IR – coils, clips, vasospasm tx | surgical interventions
   b. PLEX and plasmapheresis
   c. Antidepressants: TCAs, SSRIs, Li, other, Antipsychotics
   d. NM blockers

ICU Ethics

22. Organ donation

23. Palliative care, hospice and autonomy

24. Impaired provider

Bundles / Special Topics

25. Poisons, toxic ingestions, overdoses

26. Thermoregulation: heat stroke, fever, Malig Hyperthermia, NMS, Serotonin syndrome


d. NMS, a more detailed review, 2015: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4812801/

27. Hypothermia

      i. If you cool, give ABX for VAP: NEJM 2019: https://pubmed.ncbi.nlm.nih.gov/31693806/


   c. TTM 33 vs. 36 after OOH Arrest, NEJM 2013: https://pubmed.ncbi.nlm.nih.gov/24237006/


Additional Worthwhile Readings:

   a. CEA, BJA 2007 (around when the surgeons quit staying up to date): https://academic.oup.com/bja/article/99/1/119/269458

Post-Intensive Care Syndrome


Section 5: Renal, Fluids & Electrolytes

1. **Diagnoses**
   a. Infection, Trauma, Transplant and rejection
   b. Failure – pre/post/intrinsic
   c. Contrast nephropathy, HRS,
   d. Blood gases, lytes, osmolarity, spec grav of serum & urine
   e. Angiography, CT/MRI, AXR, Renal US, Renal Bx

2. **AKI and Renal Failure**
   c. See MAP goals section in “Cardiovascular”

3. **Fluids & Lytes**
   e. CRISTAL Trial, crystal/colloid in ICU with hypoV shock, JAMA 2013: https://pubmed.ncbi.nlm.nih.gov/24108515/

4. **Electrolytes**
5. **Buffers, Diuretics, N-acetylcysteine**

6. **RTA, Rhabdo**
   c. Rhabdo review Dx/Tx, Ochsner 2015: [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4365849/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4365849/)

7. **Infections & ABx**

8. **RRT: CVVH including ultrafiltration, IHD, PD**

9. Osmolarity and spec grav (serum, urine)
Section 6: Endocrine, GI including Liver, Nutrition

1. **Adrenal** – insufficiency, cushing’s, pheochroma, Carcinoid/other
   - In Sepsis
   - Other
     j. Sepsis as a Pan-Endocrine Illness: J Clin Med 2021: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8152097/

2. **Pituitary** - salt wasting, DI (central, nephron), SIADH, Panhypopit of various etiologies.
   - a. Dx/Tx of Hypopituitarism, Endo Metab 2015: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4722397/

3. **Thyroid** – critical euthyroid, hyperT/storm, hypoT/myxedema

4. **DM- DKA, NKHC, hypoG**
d. Individualizing Glucose control - DM vs. Non-DM & Many Glucose Metrics: JDST 2018

e. An editorial on individualized glucose control and how challenging it is to achieve: ICM 2021:


g. Perioperative glycemic control, an update, Anesthesiology 2017:

h. The Perils of Perioperative Dysglycemia, International Anesth Clinics, 2020:

5. Diagnostics: CT, labs (serum, urine), US
6. Management: Anti-HTN, Hormone replacement, glucose management (oral antihyperglycemics, insulin), steroids (GC and MC), Vasodilators, Vasopressin & DDAVP

**Gastrointestinal**

7. Abd compartment Syndrome, intraabdominal hypertension & Management
   b. Consensus Def & Guidelines, ICM 2013: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3680657/
   c. ACS, Stat Pearls: https://www.statpearls.com/ArticleLibrary/viewarticle/19771

8. **Bowel:** Including surg intervention timing and tx options
   a. Infections
   b. Perforation and volvulus
   c. Pseudomembranous colitis
   d. Bowel ischemia

9. **Gallbladder**
   a. Interventional approaches to gallbladder dz, NEJM 2015:

10. **Stomach:** UGIB, LGIB, gastritis, ulcer
       i. The Villanueva trial has a worthwhile WikiJournalClub to consider:
       https://www.wikijournalclub.org/wiki/Transfusion_Strategies_for_Acute_Upper_Gastrointestinal_Bleeding
    c. Endoscopy <6h vs. 6-24h no different in UGIB, NEJM 2020:
    d. GI Prophylaxis: see bottom of this section.

11. **Dysmotility,** GERD, diarrhea, n/v, ileus, toxic megacolon, malabsorption
12. **Pancreas, pancreatitis, cancer**

13. **Hepatic** – dysfunction, failure (acute/chronic), HE, HRS, HCC, HPS, Hepatitis, Liver Tx rejection and complications; Lactulose and rifaximin
   d. Neuro complications after Liver Transplant, WJ Hepat 2013: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3767839/
   j. Cirrhosis:
      iv. Hepatopulmonary Syndrome:
   k. NON-HEPATIC Hyperammonemia: Diagnosis & Management, J Crit Care 2022

14. **GI Prophylaxis**

15. Diagnostics

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16. Management
   a. IgG / immunotherapy, IR embolization and coiling
   b. GI Blood flow modulators
   c. Hepatitis vaccination

Nutrition
17. EN, PN, formula and caloric intake
   d. Trophic or Full EN in ICU: CoCC 2018: https://pubmed.ncbi.nlm.nih.gov/29877878/

18. Tx/Dx: Enteral tubes, metabolic assessment (basal, stress energy requirements), indirect calorimetry and nitrogen balance, refeeding syndrome.
1. Coagulopathies – acquired: DIC, factor abnormalities, Vit K dependent, congenital, hypercoagulable state. Coag studies including viscoelastics, routine blood studies

2. Fibrinolysis
   b. Therapeutics Targeting the Fibrinolytic System, Nature sub-journal 2020: https://www.nature.com/articles/s12276-020-0397-x

3. Hb abnormalities
   a. Anemia – polycythemia, carboxyHb, Methemoglobin, other – sickle, thalassemia

4. Plt abnormalities: thrombocytosis, ITP, TTP, thrombocytopenia, HIT and Plt Dysfunction

5. Leukemia, Lymphoma, Tumor lysis syndrome, white blood cell disorder, BMT, Stem cell transplant. BM Biopsy and culture. EPO, G-CSF


6. Anticoagulants:
   a. Heparin, LMWH, Unfractionated
   b. Warfarin; Antiplatelet agents; Thrombin inhibitors- argatroban; Thrombolytics; Anticoagulation, antithrombotics; Antiplatelet agents; Antifibrinolytics; Factor Xa inhibitors and DOACs
   c. Transfusion & factor replacement
   d. IVC filters and “other mechanical devices” - See CardioVascular
   e. PLEX, Plasmapheresis

Transfusion Thresholds
7. Transfusion in ARDS / Ventilated patients, ICM 2020 narrative: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7658306/
   a. Septic Shock
ii. TRISS study, 7 vs. 9, NEJM 2014:  

iii. TRICC Study, the original NEJM 1999 (9 vs. 7):  

b. Perioperative
   i. Liberal works periop, not ICU, meta-analysis of RCTs, BJA 2015:  
   ii. TRICS III Trial: Cardiac Surgery, 7.5 vs. 9.5 ICU / 8.5 Ward, NEJM 2015:  
   iii. Same study, 6m Follow-up, No difference between thresholds, NEJM 2018:  

c. With Myocardial Infarctions
   i. Addressing Mortality, JAMA Int Med 2013:  
   ii. In ACS, Liberal may be better – metanalysis & systematic review: J Am Heart Assoc 2023:  
https://www.ahajournals.org/doi/10.1161/JAHA.122.028497


8. TRALI, TACO (from Respiratory)
   a. TRALI – Perioperative review, Anesthesiology 2019:  

Immune

9. Diagnoses:
   a. A/I – mixed CT disease, RA, SLE, Vasculitides
   b. Serologies and immune studies
   c. Immune Suppression, acquired – HIV/AIDS
   d. GVHD (see onc section)
   e. Pharm: Abx, prophy abx, HAART, steroids
   f. Other:
      i. IDSA Guidelines - Neutropenic Fever, Clin ID 2011:  
      ii. Neutropenic Typhlitis, Spectrum & Fungal Risk, CCM 2019:  

Infectious Catch-All

10. Diagnoses:
   b. Genetic considerations
   c. Infection Control, Isolation techniques & Environmental exposures (Needle sticks Management / Risks)
   d. Nosocomial infections: CAUTI, CLABSI and lines, PNA-VAP, HAP
      i. See the IDSA guidelines for varied infectious emergencies
      ii. See line risks in Procedures
      iii. See PNA / HAP in Resp
      iv. See CAUTI in Renal
11. Other ID:
   b. Infectious complications after solid organ transplant, Crit Care Clin 2019: 
      https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7127653/
   c. Duration of Hypotension before ABx and Mortality, CCM 2006: 

12. NON-HEPATIC Hyperammonemia: Diagnosis & Management, J Crit Care 2022
1. Obstetrics & Pregnancy
   a. Physiologic changes in pregnancy
   b. Pre-eclampsia, eclampsia
   c. Emboli – amniotic fluid, VTE
   d. Liver function
   e. Coagulopathy, bleeding disorders
   f. Peripartum infection
   g. Peripartum cardiomyopathy
   h. Airway/Resp changes, pulm physiology
   i. Diagnostics: Ultrasound, cardiotocography
      i. https://pubmed.ncbi.nlm.nih.gov/34011889/ (Fetal testing)
   j. Management: Anticoagulation, Anticonvulsants, Anti-HTN, Abx, Delivery

Dermatology

2. Allergic reactions
3. **Disruptions of skin**: infections, cellulitis, necrotizing soft tissue, ulcers / decubiti

4. **Stevens-Johnsons and other Derm Emergencies**:
   b. SJS & TEN, Focus on Tx Options/Support, 2017: [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5487863/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5487863/)
   f. Abstract / Newsletter “Description from an expert” - Page 26 HERE.

5. **Dx: ESR and CRP**
   b. CRP in infections, BMJ Open 2018: [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6318522/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6318522/)
   c. Procalcitonin as a metric of trauma, Crit Care 2019: [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6892215/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6892215/)

6. **Tx: Steroids – systemic and topical. Antihistamines, immunotherapies and topical med.**
7. **Tx: Wound care**

**Burns**

8. **Complications, electrical, inhalational**
9. **Management including airway, abx, fluids/resuscitation, hyperbaric tx, “other”**
0704(16)30064-1/fulltext and colloids, here: https://www.criticalcare.theclinics.com/article/S0749-0704(16)30050-1/fulltext


Biostatistics: Please see separate Teams file: Hess Math & Statistics, by Dr. Aaron Hess.

g. NNT, OR, and RR

h. ROC

i. Regression analysis, sample size estimates

j. Sens/Spec, PPV/NPV, Confidence intervals

k. P-values and significance

l. Tests: Non-parametric: Wilcoxon, mann whitney u-test, chi squared, Kaplan meier; parametric: t-test, ANOVA

m. Type 1 and type 2 errors.

Other Stats Issues (not on content outline):


q. Bias in Before & After Studies: https://journals.lww.com/anesthesia-analgesia/Fulltext/2018/05000/Bias_in_Before_After_Studies__Narrative_Overview.49.aspx

r. Observational Studies, Cohort & Case Control: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2998589/

s. Scientists rise up against statistical significance! Nature, 2019: https://www.nature.com/articles/d41586-019-00857-9

t. Lessons learned from negative trials & how to improve research in the ICU, Anesth Crit Care Pain Med, 2020: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8166406/

Organizational Issues

u. HIPAA

v. ICU transport

w. HCAPS measures

x. QA/QI / Safety, regulatory requirements

y. Telemedicine and triage.
z. APACHE and SOFA
   i. SOFA – a recent review including evolution and challenges, Critical Care 2019: 
   ii. Serial Delta-SOFA to predict outcomes, JAMA 2001: 
   iii. SOFA Score: Time for an Update? Crit Care 2023: 