Assessing Your Critically Ill Patient: Beyond the Primary Cardiopulmonary Assessment

CHRISTINE GLUVNA, MS, RRT-ACCS
WEST DISTRICT DIRECTOR AND EDUCATION COMMITTEE CHAIR, PSRC
ASSISTANT PROFESSOR/PROGRAM DIRECTOR, MERCYHURST UNIVERSITY
STAFF THERAPIST, SELECT SPECIALTY HOSPITAL - ERIE

Objectives

- Describe the importance of employing a holistic approach to patient assessment in the critically ill patient.
- Identify additional assessment measures and indices that can provide vital information in the treatment of the critically ill patient.
- Describe how information gathered from holistic patient assessment might be applied to the diagnosis and treatment of dysfunction in the critically ill patient.

Why Isn’t a Primary Cardiopulmonary Assessment Enough in the Critically Ill Patient?

- While cardiopulmonary assessment is vital to the treatment of critically ill patients, it does not reveal all factors impacting the patient’s clinical course
- A holistic approach allows us to examine all factors that impact a patient’s overall clinical condition
- A solid understanding of other assessment criteria and their impact on the patient allows us to better collaborate with other members of the healthcare team and provide better patient care and outcomes

What Other Components of Patient Assessment Can Contribute to a More Holistic Approach to Patient Care?

- Patient's Medical Record
- GCS
- RASS
- Lab Values
- Renal Function, Fluid Status
- Medication List
- Nutritional Assessment
- Berlin Criteria
- Oxygenation Index
- Global Monitoring Indices

Evaluation of the Patient Medical Record

- Sometimes the answers we are looking for are found in the patient's past medical history
- All patient assessment findings are accessible
- Knowing the patient's baseline status allows us to identify areas for true concern

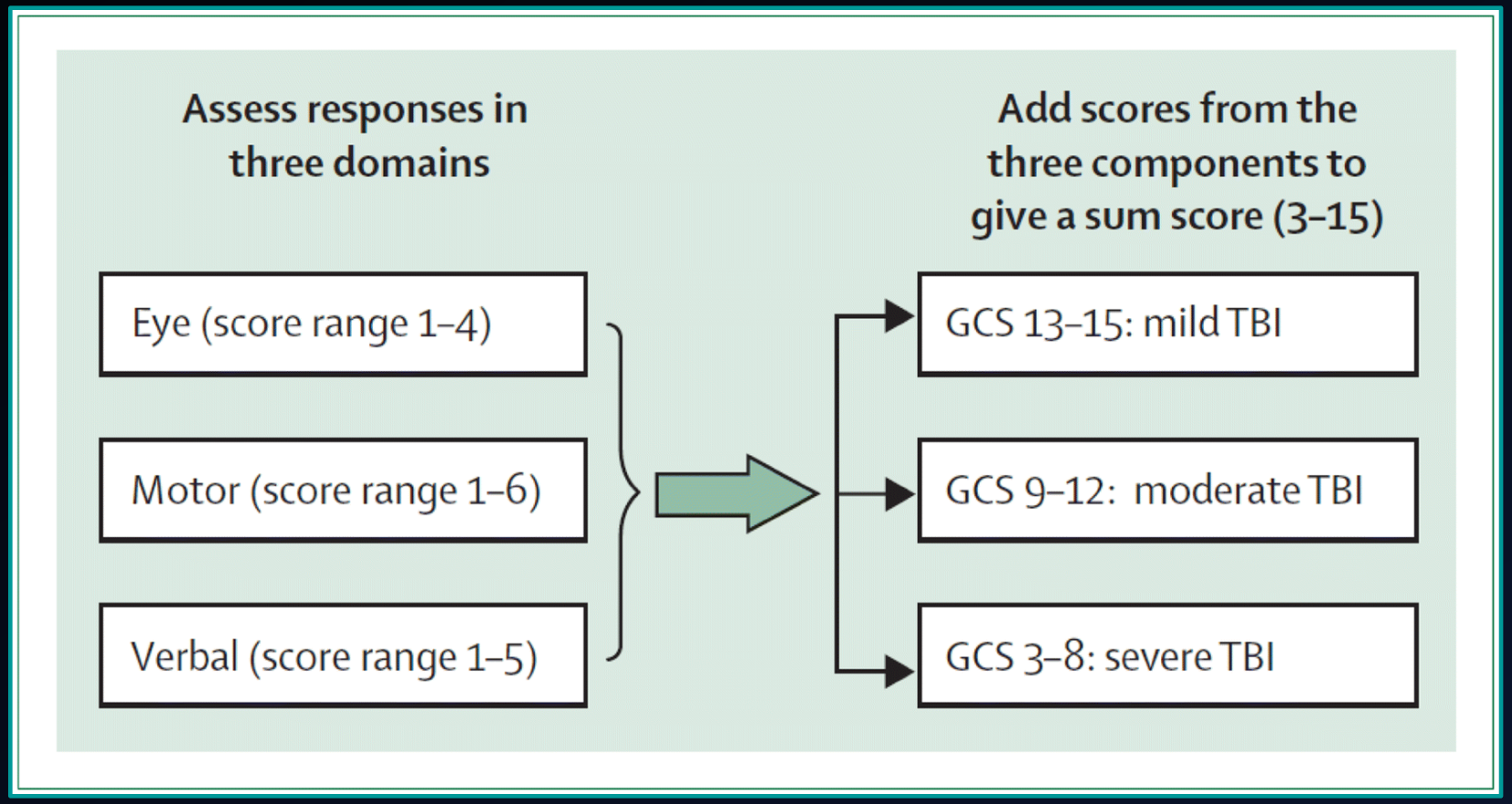
Glascow Coma Scale (GCS)

- Tool for evaluating a patient's level of consciousness after brain injury
- Evaluates patient's eye movements (E), verbal responses (V), and motor responses (M)
- Range of scores: 3-15
- Scores of 3-8 indicate severe traumatic brain injury and the need for intubation

Glascow Coma Scale

Best eye response (E)	Spontaneous – open with blinking at baseline	4
	Opens to verbal command, speech, or shout	3
	Opens to pain, not applied to face	2
	None	1
Best verbal response (V)	Oriented	5
	Confused conversation, but able to answer questions	4
	Inappropriate responses, words discernible	3
	Incomprehensible speech	2
	None	1
Best motor response (M)	Obeys commands for movement	6
	Purposeful movement to painful stimulus	5
	Withdraws from pain	4
	Abnormal (spastic) flexion, decorticate posture	3
	Extensor (rigid) response, decerebrate posture	2
	None	1

Glascow Coma Scale



Richmond Agitation Sedation Scale (RASS)

- Tool to assess the level of alertness and/or agitation in critically ill patients.
- Should be assessed q2hr in critically ill patients
- Desired level is ordered by physician or protocol
  - Typically, 0 to -1
- Serves as a guideline for titrating sedation and maintaining patient comfort

Richmond Agitation Sedation Scale (RASS)

Richmond Agitation Sedation Scale (RASS)

Target RASS	RASS Description
+ 4	Combative, violent, danger to staff
+ 3	Pulls or removes tube(s) or catheters; aggressive
+ 2	Frequent nonpurposeful movement, fights ventilator
+ 1	Anxious, apprehensive , but not aggressive
0	Alert and calm
- 1	awakens to voice (eye opening/contact) >10 sec
- 2	light sedation, briefly awakens to voice (eye opening/contact) <10 sec
- 3	moderate sedation, movement or eye opening. No eye contact
- 4	deep sedation, no response to voice, but movement or eye opening to physical stimulation
- 5	Unarousable, no response to voice or physical stimulation

Complete Blood Count (CBC)

- Measurement of all components of blood - RBC, Hb, Hct, WBC
- RBC, Hb, Hct are all interrelated
  - High values indicate polycythemia
  - Low values indicate anemia
- WBC
  - Increased (leukocytosis) in bacterial infections
  - Decreased (leukopenia) in viral infections

Electrolytes

- Electrolyte imbalances can cause muscle weakness/soreness, nausea, and mental status changes
- Potassium
  - Hypokalemia: metabolic alkalosis, excessive diuretic use, vomiting/gastric suction, diarrhea, malnutrition
  - Hyperkalemia: acidemia, renal failure
- Sodium
  - Hyponatremia: fluid loss (diuretics, vomiting, diarrhea, fluid gain from CHF/aggressive IV therapy)
  - Hypernatremia: dehydration

Electrolytes

- Chloride
  - Major extracellular ion, will change in same direction as Na^+ or K^+
  - Hypochloremia = metabolic alkalosis
  - Hyperchloremia = metabolic acidosis
- Calcium
  - Required for muscle contraction, nerve impulse transmission
  - Hypocalcemia: common in critically ill patients and leads to hypotension, bradycardia, arrhythmias, heart failure, cardiac arrest

Electrolytes

- Phosphorus
  - Hypophosphatemia primarily affects neuromuscular and CNS and can cause muscle weakness, respiratory failure, and mental status changes
  - Deficiencies can cause failure to wean from mechanical ventilation
- Magnesium
  - Hypomagnesemia can be caused by renal disease, hypokalemia, gastric depletion and malnutrition
  - Abnormalities can cause CV, NM, and electrolyte abnormalities and lead to failed attempts at weaning from mechanical ventilation

Cardiac Biomarkers

- Troponin
  - Indicator of cardiac muscle damage
  - Elevated levels seen in MI
  - Levels > 0.10 ng/mL are associated with an increased risk of death
- Brain Natriuretic Protein (BNP)
  - Secreted by heart muscle as heart failure develops or worsens
  - Key in differential diagnosis between CHF and COPD
  - Levels >100 pg/mL indicate CHF

Non-Cardiac Biomarkers

- Lactate
  - Indicator of overall oxygen delivery to tissues, produced by anaerobic metabolism due to cellular hypoxemia
  - Elevated levels seen with sepsis
- Procalcitonin
  - Diagnostic test for sepsis
  - >2.0 ng/mL indicate severe sepsis
  - >10.0 ng/mL indicate septic shock

Non-Cardiac Biomarkers

- Anion Gap
  - Difference between + cations (Na^+, K^+) and - anions (Cl^-, $HCO3^-$)
  - Increased anion gap is indicative of metabolic acidosis (diabetes, renal failure)
- D-dimer
  - Used to rule out presence of abnormal clotting (PE, DVT)
  - Decreased (negative) values = no clots
  - Increased (positive) values = clots

Non-Cardiac Biomarkers

- Albumin
  - Protein produced by the liver
  - Low albumin = malnutrition, liver damage, or inflammation
  - High albumin = acute infection, burns, stress from trauma or MI

Assessment of Renal Function

- Creatinine
  - BEST INDICATOR OF RENAL FUNCTION
  - Waste product filtered out by kidney
  - Elevated levels are indicative of renal failure
- Blood Urea Nitrogen (BUN)
  - Waste product synthesized by the kidney
  - Increased levels may indicate renal failure – confirm with Creatinine

Fluid Status/Balance

- Evaluated through I&O
- Normal urine output 1-2 L/day
- What happens when I’s are in excess of O’s?
  - Weight gain
  - Increased hemodynamic pressures (CVP)
  - Decreased lung compliance
  - Electrolyte imbalances

Medication List

- The medication list can give insight into the patients overall clinical presentation
  - Sedation
  - Analgesics
  - Diuretics
  - IV fluids
  - Steroid administration

Nutritional Assessment

- Typically conducted by a registered dietician to collect and evaluate data reflective of the patient's nutritional status
- Five areas evaluated:
  - Food/nutrition related history, anthropometric measurements, biochemical data, physical findings, patient history

Nutritional Assessment

- Macronutrients that provide for the body's energy requirements:
  - Protein – 20%
  - Carbohydrates – 45-65%
  - Fat – 20-30%
- Protein malnutrition impacts diaphragmatic function and can present challenges with weaning from MV
  - Primary PEM is typically only seen in developing countries
  - Secondary PEM occurs with underlying illness that leads to decreased intake, nutrient losses, and increased demands

Respiratory Concerns with Malnutrition

- Dysfunction of respiratory muscles
  - Diaphragm and accessory muscles
- Diminished hypoxic and hypercapnic responses
- Increased likelihood of respiratory infections
  - Decreased secretion clearance mechanisms, increased bacterial colonization, decreased secretory IgA
- Parenchymal structure changes
  - Reduced surfactant production and minimized protection against enzymatic digestion

Berlin Criteria

- Identifies severity of ARDS

	Mild ARDS	Moderate ARDS	Severe ARDS
Timing	Within 1 week of a known clinical insult or new or worsening respiratory symptoms		
PaO2/FiO2 Ratio	200-300	100-200	<100
PEEP	≥ 5 cmH_2O	≥ 5 cmH_2O	≥ 10 cmH_2O
CXR	Bilateral opacities		

Oxygenation Index (OI)

- Assesses the level of ventilatory support required to maintain oxygenation

Oxygenation Index (OI)
To calculate OI $OI = \frac{\text{Mean Airway Pressure x FiO2 (\%)}}{PaO_2 \text{ (mmHg)*}}$ OI < 5 = Normal OI > 10 = Severe oxygenation problem OI > 20 = Extreme oxygenation problem OI > 40 = ECMO referral *To calculate this figure when using kPa, multiply the PaO_2 by 7.5 before completing the above calculation.

APACHE II Scoring System

- Acute Physiology and Chronic Health Evaluation
- Global monitoring index for severity of illness
- Assigns points to physiologic variables based on level of abnormality in values
- APACHE score is derived from the sum of all assigned points
- Used to assign risk of mortality

APACHE II Scoring Criteria

- Age
- GCS
- Temperature
- MAP
- Heart Rate
- Respiratory Rate
- PaO_2/ A-a Gradient
- pH/HCO_3^-
- Na^+
- K^+
- Creatinine
- Hct
- WBC

Interpretation of APACHE II Scoring

- Increased APACHE scores are associated with increased risk of mortality
- 0 to 4 points = 4% non-op, 1% post-op
- 20 to 24 points = 40% non-op, 30% post-op
- 30 to 34 points = 73% for both
- 35 to 100 points = 85% non-op, 88 post-op

Patient Scenario #1

A 75-year-old female patient with a history of CHF and COPD presents to the Emergency Department with complaints of increased shortness of breath over the last three days. She was recently completed a course of antibiotics for bacterial pneumonia. What assessments should be performed as part of the differential diagnosis to determine the cause of the patient's worsening SOB?

Patient Scenario #1

- CBC
- BNP

Patient Scenario #2

A 60-year-old patient is transferred to your facility following intubation for a higher level of care. He has received treatment with IV antibiotics for bacterial pneumonia for one week. Oxygen requirements and PEEP requirements have progressively increased, and his hypoxemia has been refractory to treatment. CXR reveals bilateral opacities. What assessments should be performed?

Patient Scenario #2

- CBC
- Lactate/Procalcitonin
- Berlin Criteria

Patient Scenario #3

A 45-year-old patient who has received MV for two weeks has failed multiple attempts at weaning. The patient displays signs of respiratory distress during attempts at weaning and spontaneous volumes are well below predicted values. The patient only tolerates enteral feeds via NG tube at low rates and experiences high residuals with each attempt at increasing rate. What assessments should be performed to identify potential causes for the patient's failed weaning attempts?

Patient Scenario #3

- Electrolytes
- Medication list
- Nutritional assessment

Christine Gluvna, MS, RRT-ACCS

cgluvna@mercyhurst.edu