



Chapter 16 - Depressed consciousness and coma

Episode overview:

- 1) List a broad differential diagnosis for coma
- 2) List GCS / Pediatric GCS
- 3) Describe the oculocephalic and oculovestibular reflex

Wise Cracks:

- 1) List the common age-related causes of altered mental status
- 2) What is the initial investigation management of an altered LOC patient?

Rosen's in Perspective:

Depressed mental status represents an *alteration in arousal* stemming from a wide spectrum of diseases and presenting on a continuum of impairments. These impairments range from sleepiness, to decreased alertness, to coma. A common approach to this broad differential is DIMS, which is covered later in this episode.

Physiology

Consciousness is the awareness of one's self or surroundings, and is composed of:

- **Arousal** – *this* is what we refer to as “altered” in altered level of consciousness
 - Dynamic levels on a continuum:
Fully alert ↔ Stuporous ↔ Comatose ↔ Complete unconsciousness
 - **Cognition** – a *composite* of several factors leading to “states” of consciousness:
 - Orientation – *accurate perception* of what is experienced
 - Judgement – ability to *process* data in order to generate more meaningful info
 - Memory – ability to *store* and *retrieve* information
- Many medical states can alter cognition (confusion, inattention, delusions, dementia) however, since these states do not depress *level of arousal*.

Pathophysiology

Arousal is controlled by the *ascending reticular activating system* (ARAS) in the paramedian tegmental zone of the *dorsal brainstem*

- Determines *arousal* and *cortical activation*

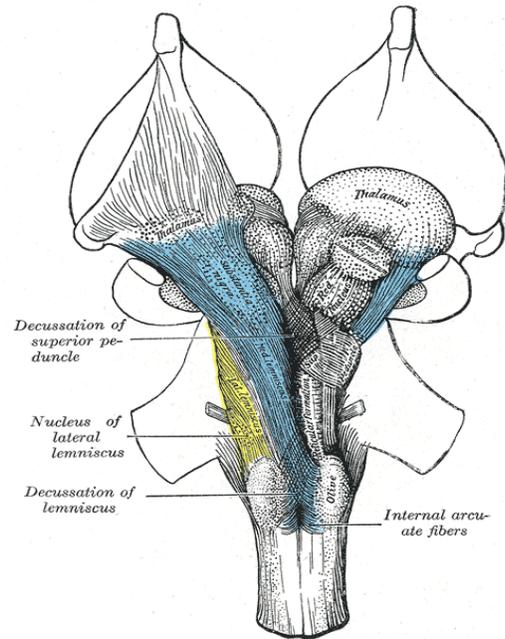
Cognition is primarily controlled by the *cerebral cortex*

- Determines *content* of consciousness

Therefore anything impacting normal function of the brainstem (small lesion = large deficit) or *bilateral* cortex can cause *depressed consciousness or coma*.

The three categories of processes that insult these anatomical areas include:

- Metabolic derangements
- Toxins
- Mechanical injury



1) List a broad differential diagnosis for coma

Break down of table 16-1: using the DIMES approach (“if you don’t think of it you’ll never dx it”)

★ Drugs:

The “OB’s 5Cs” as the **Critical diagnoses**:

1. **Opiates**
 2. **Beta-blockers**
 3. **Carbon monoxide**
 4. **Cyanide**
 5. **CCBs**
 6. **Cyclic antidepressants**
 7. **Cardiac glycosides**
- Abuse: heroin, opiates, benzodiazepines, alcohol, cocaine, amphetamines, marijuana, LSD, mushrooms, GHB
 - Accidental: Carbon Monoxide / Cyanide
 - Acquired: BB, CCBs, digoxin, TCAs, acetaminophen, ASA, SSRI, anticonvulsants

★ Infection

- Meningitis, encephalitis,
- Septic shock and sepsis



- ★ **Metabolic** (by organ system)
 - Pancreas:
 - **Hypoglycemia**
 - DKA, HONK
 - Thyroid (hyper or hypothyroid)
 - Kidneys (electrolyte derangements, kidney failure with uremic state)
 - Liver (hepatic encephalopathy)

- ★ **Environmental**
 - High altitude cerebral edema
 - Heat stroke
 - Hypothermia
 - Dysbarism

- ★ **Structural**
 - Intracranial Catastrophe
 - ICH, Stroke, Epidural hematoma, Subdural hematoma, SAH
 - Status epilepticus, acute hydrocephalus
 - Cardiac
 - ACS, Aortic Dissection
 - Cardiogenic / Hypovolemic / Obstructive / Distributive shock
 - HTN crisis, malignant arrhythmia



Table 16-1 Differential Diagnosis

ORGAN SYSTEM	CRITICAL DIAGNOSES	EMERGENT DIAGNOSES	NONEMERGENT DIAGNOSES
Neurologic or CNS	Hemorrhage <ul style="list-style-type: none"> • Subarachnoid • Pontine • Cerebellar • Intracerebral Ischemic stroke Status epilepticus Acute hydrocephalus	Subdural hematoma Epidural hematoma Acute hydrocephalus Primary brain tumor Metastatic disease Venous sinus thrombosis CNS vasculitis Pseudotumor cerebri Seizures (limited)	Concussion or contusion
Infectious	Bacterial meningitis Encephalitis Septic shock	Brain abscess Viral meningitis Sepsis from other sources	
Metabolic	Hypoglycemia	Hyperglycemia (DKA, HONK) Thiamine deficiency (Wernicke-Korsakoff syndrome) Hyponatremia or hypernatremia Hypocalcemia or hypercalcemia Hyperammonemia Myxedema coma Thyrotoxicosis Uremia Porphyrria	Hypophosphatemia Hypomagnesemia or hypermagnesemia Hypoparathyroidism or hyperparathyroidism
Toxic	Carbon monoxide Cyanide Heroin or opiates Beta-blockers Calcium channel blockers Cardiac glycosides (digoxin) Tricyclic antidepressant	Alcohol Benzodiazepines Cocaine, amphetamines γ-Hydroxybutyrate (GHB) Isoniazid Organophosphates Acetaminophen Anticonvulsants Aspirin Lithium PCP SSRIs	Marijuana LSD Mushrooms NSAIDs
Environmental	High-altitude cerebral edema Heat stroke Hypothermia Malignant hyperthermia Neuroleptic malignant syndrome	Dysbarism	
Pulmonary, hypoxia	Anaphylaxis Pulmonary embolus	Asthma, COPD	
Cardiovascular	Acute MI Aortic dissection Cardiogenic shock Cardiac tamponade Hypovolemic shock Hypertensive crisis Malignant arrhythmia	Congestive heart failure Anemia	

CNS, central nervous system; COPD, chronic obstructive pulmonary disease; DKA, diabetic ketoacidosis; HONK, hyperosmolar nonketotic coma; LSD, lysergic acid diethylamide; MI, myocardial infarction; NSAIDs, nonsteroidal anti-inflammatory drugs; PCP, phencyclidine; SSRIs, selective serotonin reuptake inhibitors.

Box 16-1 Structural Etiology of Altered Mental Status and Coma

- Trauma**
 - Subdural hematoma
 - Epidural hematoma
 - Cerebral concussion or contusion
- Stroke Syndromes**
 - Embolism
 - Cardiac (atrial fibrillation, endocarditis)
 - Paradoxical (fat embolus)
 - Thrombosis
 - Cerebral venous sinus thrombosis
 - Hemorrhage
 - Subarachnoid hemorrhage (SAH)
 - Pontine hemorrhage
 - Cerebellar hemorrhage
 - Intracerebral hemorrhage
- Tumor**
 - Brainstem tumors
 - Metastatic disease
 - Angiomas
 - Pituitary apoplexy
 - Acute hydrocephalus
- Infection**
 - Subdural empyema or abscess

AEIOU TIPS Approach to Altered LOC

- A**
 - Anaphylaxis or altitude illness or alcohol
- E**
 - Epilepsy (pre, intra, or post ictal) or Environmental (hypo/hyperthermia or altitude)
- I**
 - Infection
- O**
 - Overdose of drugs (insulin, benzos, etc.)
- U**
 - Underdose of drugs
- T**
 - Trauma (TBI, hemorrhage) / Tumour
- I**
 - Insulin
- P**
 - Psychogenic / Poisons
- S**
 - Stroke / Shock



2) List GCS / Pediatric GCS

Need to know this!

- Glasgow Coma score <8 intubate.
- Remember change >2 points is significant change.
- Recent SMACC talk (Mark Wilson SMACC Chicago) discusses need to describe *specifically* what E, M and V are. See: <http://www.smacc.net.au/2016/03/goodbye-gcs-mark-wilson/>

Box 16-3 Glasgow Coma Scale

		Score
Eye opening	Spontaneous	4
	To voice	3
	To pain	2
	None	1
Verbal response	Adult	
	Oriented	5
	Confused	4
	Inappropriate words	3
	Incomprehensible words	2
	None	1
Pediatric	Adult	
	Appropriate	5
	Cries, consolable	4
	Persistently irritable	3
	Restless, agitated	2
	None	1
Motor response	Pediatric	
	Obeyes commands	6
	Localizes pain	5
	Withdraws to pain	4
	Flexion to pain	3
	Extension to pain	2
	None	1

“V”

- Adult and pediatric scoring varies
- “V” for 5 possible scores

“M”

- Most (6) possible scores

Sign	Glasgow Coma Scale ^[1]	Pediatric Glasgow Coma Scale ^[2]	Score
Eye opening	Spontaneous	Spontaneous	4
	To command	To sound	3
	To pain	To pain	2
	None	None	1
Verbal response	Oriented	Age-appropriate vocalization, smile, or orientation to sound, interacts (coos, babbles), follows objects	5
	Confused, disoriented	Cries, irritable	4
	Inappropriate words	Cries to pain	3
	Incomprehensible sounds	Moans to pain	2
	None	None	1
Motor response	Obeys commands	Spontaneous movements (obeys verbal command)	6
	Localizes pain	Withdraws to touch (localizes pain)	5
	Withdraws	Withdraws to pain	4
	Abnormal flexion to pain	Abnormal flexion to pain (decorticate posture)	3
	Abnormal extension to pain	Abnormal extension to pain (decerebrate posture)	2
	None	None	1
Best total score			15

3) Describe the oculocephalic and oculovestibular reflex

Important tests, as if they give a normal response then a structural lesion in brainstem is unlikely

Oculo-Cephalic - *Doll's eyes*.

Make sure no contraindications (mainly c-spine precautions)

- Observe eyes with moving head side to side (cervical rotation).
- If eyes remain fixed / frozen in orbits, this is an *abnormal* response
- If eyes maintain forward gaze despite turning the head, this is a positive doll's eye reflex and is considered the *normal response*

Oculo-Vestibular - *Cold Calorics*.

Ensure no perforated tympanic membranes / Excessive earwax

- Elevate patient's head 30 degrees OR reverse trendelenburg (if c-spine precautions)
- Instill 10-30cc of ice cold water into ear
- Observe eye movements

REMEMBER COWS - Cold Opposite, Warm Same

- Referring to direction of nystagmus in relation to water

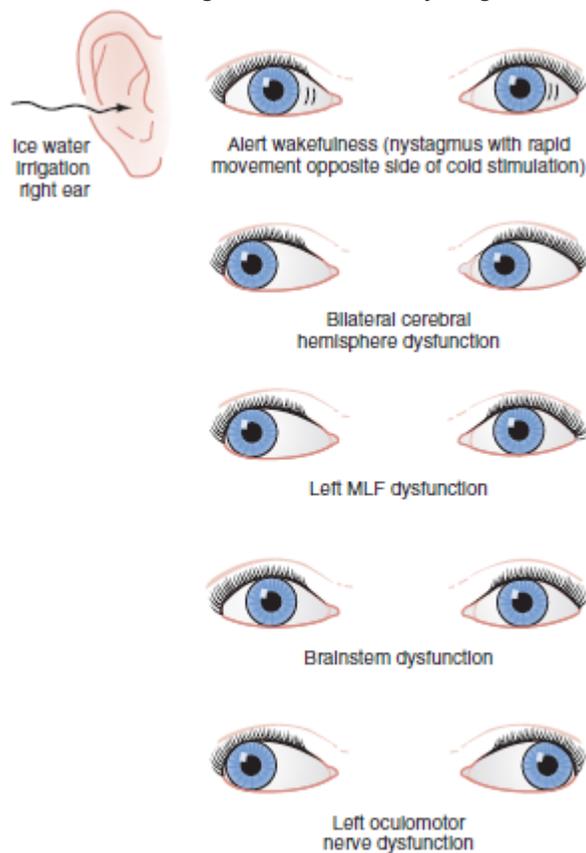


Figure 16-2. Oculocephalographic (caloric) responses to various central nervous system pathologic conditions. *MLF*, medial longitudinal fasciculus.

If there is an intact brainstem:

- Instilling cold water into right external auditory canal will result in *slow* conjugate deviation towards to the cold ear for 30-120 seconds, with *fast* nystagmus beats away from the cold ear.

If the **brainstem** is not intact:

- There will be no movement with irrigation.

Wise Cracks

1) List the common age related causes of altered mental status

Box 16-2	Common Age-Related Etiology of Altered Mental Status
Infant	Infection Trauma, abuse Metabolic
Child	Toxic ingestion
Adolescent or Young Adult	Toxic ingestion Recreational drug use Trauma
Elderly	Medication changes Over-the-counter medications Infection Alterations in living environment Stroke

2) What is the initial management of an ALOC patient:

Step 1: MOVIE (monitors, oxygen, vitals, IV, environment)

Step 2: ABCs

Step 2: Blood Sugar, Temp, ECG

Step 3: Coma Cocktail: Dextrose, Oxygen, Narcan, Thiamine

Step 4: CXR, CT Head, Consider antibiotics +/- antivirals, metabolic antidotes,
Trauma management, secondary surveys