

Altered Mental Status Emergency Evaluation

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Objectives

- Define terminology
- Discuss common **emergency** conditions associated with altered mental status (AMS)
- Work up and evaluation of AMS
- Treatment and therapy

Altered Consciousness Terminology

Altered consciousness represents a continuum between normal alertness and coma.

Disturbances in perception can also alter mental status, and though fully awake can have marked abnormalities in cognition, behavior, and reality testing

Altered Consciousness Terminology

- Lethargy – reduced wakefulness but arousable and will respond appropriately
- Confusion – slow thinking, inattention, disorientation, impaired memory
- Stupor – a state of unresponsiveness in which arousal only occurs with vigorous and repeated stimuli

Altered Consciousness Terminology

- Obtunded – Severe blunting of alertness with decreased response to stimuli
- Coma - Profound unconsciousness which results in the inability to be aroused or respond

Altered Consciousness Terminology

- Delirium – sensory misperception, characterized by disorientation, suspiciousness, agitation, hallucinations
- Hallucinations - a false sensory perception in the absence of an external stimulus

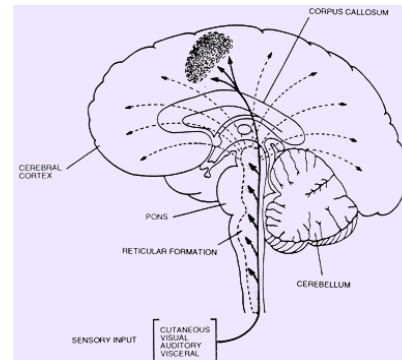
(Source - [Diseases Database](#))

What is consciousness?

- Maintenance of arousal
- Ability to respond to environment with full cognitive functions
- Requires a complex network of interactions of the brain prominently involving the reticular activating system and the cerebral cortex

Rudolfs Pediatrics, 21st edition, Susan Arnold, Coma and Altered Consciousness

Reticular Activating System



<http://www.sleephomepages.org/sleepsyllabus/img/image21.gif>

3 major reasons for AMS

- Brain
- Metabolic
- Toxic/Poisoning/Overdose

Brain

- Trauma
- Infection
- Blood flow
- Increased Intracranial pressure
- Seizures
- Tumors
- Psychiatric
- Neurologic presentation of Intussusception

Traumatic Brain Injury

- Concussions - Loss of consciousness
- Diffuse axonal injury – Shearing forces
- Contusions
- Subdural - Shaken baby
- Epidural
- Intraparenchymal hemorrhage
- Cerebral edema

CNS Infections

- Meningitis
- Encephalitis
- Brain abscess
- Epidural Abscess
- Subdural Empyema

Cerebral Blood Flow

- Stroke – Sickle cell, vasculitis, coagulopathy
- Thrombosis – Venous thrombosis, cavernous or sagittal sinus thrombosis
- Hypotension - SHOCK
- Hypertension – Hypertensive encephalopathy

Increased ICP

- Shunt malfunctions/hydrocephalus
- Cerebral edema
- Trauma
- Mass lesions
- Cushing's response:
 - Hypertension
 - Bradycardia
 - Abnormal Respirations

Seizures

- Any seizure can alter mental status
- Post ictal state
- Seizures
 - Epilepsy
 - Hyper- or Hyponatremia
 - Hypoglycemia
 - Hypocalcemia

Tumors

- Any space occupying lesion can cause:
- Mass effect
 - Hemorrhage
 - Seizures
 - Personality changes
 - Visual changes

Psychiatric

- Psychosis
- Hallucinations
- Unless suicidal or homicidal, purely psychiatric disorders are rarely life threatening and can be managed non-emergently

Psychiatric

- Psychosis – Severe disturbances in thought processes - hallucinations, delusions and thought disorders.
 - Organic – Physical or toxic etiology (trauma, medications, medical conditions)
 - Psychiatric - Schizophrenia

Hallucinations

- Common in children pre-school to school age
- Infrequently related to schizophrenia or psychosis
- Usually visual and tactile hallucinations are less concerning than auditory hallucinations

Hallucinations

- Often are visual and tactile, eg, “bugs crawling on child or the walls”
- May persist while fully awake and last for minutes or hours
- Usually associated with fever, drugs, illness, grief reactions
- Short lived, anxiety provoked
- No particular work up is indicated

Hallucinations

- Hypnagogic Hallucinations
 - Associated with times around waking or falling asleep
 - Combines dream and waking state
 - May be frightening such as episodes of feeling like falling, auditory or visual hallucinations

Intussusception

- Intussusception may present with a neurologic presentation
 - Lethargy
 - Unresponsiveness
 - Stuporous state

Metabolic

- Hypoxia
- Hypoglycemia
- Hypothermia
- Heat stroke/exhaustion
- Hepatic – Hyperammonemia, Reyes
- Uremia
- Endocrine
- Inborn errors of metabolism - Hyperammonemia

Metabolic - Hypoxia

- Continuous oxygen delivery is required for normal cerebral function
- Any decreases in oxygenation rapidly causes mental status changes

Mental Status Changes Associated with Hypoxia

- Early - Visual changes, loss of short term memory, inability to learn
- Later - Drowsiness, mental fatigue, headaches, vomiting, euphoria
- Latest - Loss of consciousness, brain damage (hypoxic ischemic encephalopathy)

Hypoxia

- Remember the only sign of impending respiratory failure may be mental status changes
- Respiratory distress may be entirely absent.

Hypoxia - Management

- High flow Oxygen to maintain adequate saturations
- Positive airway pressure
- Ventilation as needed

Metabolic - Hypoglycemia

- A common and easily reversible cause of altered mental status
- Brain needs a constant supply of glucose for its energy requirements
- May be associated with an endocrine problem, insulin, poor nutrition, inborn error of metabolism or toxin(alcohol or salicylates)

Metabolic - Hypoglycemia

- Signs of hypoglycemia are non specific:
 - Irritability, headache, confusion, seizure, unconsciousness
- Defined as a serum glucose < 50 mg/dl
- Glucose levels below:
 - 30mg/dl may cause confusion, disorientation
 - 10mg/dl may cause loss of consciousness

Metabolic - Hypoglycemia

- Emergency management
- 0.25mg glucose/kilogram
 - Or **2.5 cc/kg of 10% Dextrose or 3cc/kg**
 - Or 1cc/kg of 25% Dextrose (avoid for phlebitis if possible)
 - Maintenance 6-8mg/kg/min or 1.5 the maintenance rate using D 10% fluid

Temperature Related

- Hypothermia – Defined as core temperatures less than 35.5 C
 - Cerebral blood flow decreased 6-7% with each degree Celsius decrease
 - Mental status similarly decreases
 - May lapse into stupor or coma

Temperature Related

Heat related

- Heat exhaustion $T < 39\text{ C}$
 - Lethargy, agitation, headache, confusion, psychosis
- Heat stroke $T \geq 41\text{ C}$
 - Headache, confusion, impending doom, abrupt loss of consciousness, seizures

Hepatic

- Severe acute or chronic liver disease
- Elevated LFTs
- Coagulopathy
- Hyperammonemia
- Elevated bilirubin

Uremia

- Unknown mechanism but with high levels will cause encephalopathy
- Seen with end stage renal disease and usually associated with multi-organ failure

Endocrine

- Diabetes
- Insulin related
- DKA
- Addisons Disease – Adrenal Insufficiency
- Hypo- or Hyperthyroid

Toxins/Drugs

- Opiates
- Anticonvulsants
- Sedatives
- Salicylates
- Alcohols

Metabolic – Inborn Errors of Metabolism

- Usually abnormal in growth and development unless in the newborn period
- Urea cycle defects
- Hyperammonemia
- Carnitine / MCAT

Toxins/Drugs

- Antidepressants
- Phenothiazines – cough and cold medications
- Anti-cholinergics
- Iron
- Cocaine/Amphetamines
- Clonidine- alpha 2 receptor agonist causes sedation to coma with overdose

Toxins/Drugs

Poisons

- Carbon monoxide
- Organophosphates
- Lead
- Hydrocarbons

Carbon Monoxide

- COHb is measured as a percent of the blood. Smokers may have levels as high as 5 to 10%
- Clinical symptoms are *grossly* associated with levels of carbon monoxide in the blood - carboxyhemoglobin levels

Carbon Monoxide

- | | |
|----------|---|
| – 5-10% | Impairment of fine motor skills, |
| – 10-20% | Headache, dizziness, mild dyspnea, visual changes, confusion |
| – 20-40% | Drowsiness, faintness, nausea, vomiting, lethargy, irritability, judgement impairment |
| – 40-60% | Severe headache, weakness, syncope, apnea, memory loss, |
| – >60% | Coma, seizures, respiratory failure, death |
| – >80% | Rapidly fatal |

Diagnosis

- CO is rapidly distributed into the CNS and other tissues, so *again* blood levels may not reflect the severity of poisoning if a delay has occurred between exposure and measurement.
- Remember that it is the *dissolved* CO in the tissues that plays a greater role in toxicity!

Clinical Presentation

CO poisoning

- Infants and children may have an increased susceptibility to CO toxicity based on their higher metabolic rates and oxygen demand.
- One pediatric study noted that, in CO poisoning, "The most common presenting signs and symptoms were an altered level of consciousness, metabolic acidosis, tachycardia, and hypertension". Journal of Trauma-Injury Infection and Critical Care 44(1):149-54, 1998 Jan.

Diagnosis

- In adults and pediatrics the earliest symptoms of CO poisoning were: nausea, vomiting, and headache at COHb levels of 15-20%.
 - The same study found that unlike adults:
 - **Lethargy** was found in 68% of pediatric patients with a mean level of COHb of 26%
 - **Syncope** occurred in 100% of children with levels of 24% or more.
- Crocker PJ, Roberts RJ, Carbon Monoxide Poisoning in Children. Clin Toxicol 1980, 16:287-295

Basic Approach to AMS

- Are there signs of cardiovascular or respiratory insufficiency?
- Is there adequate substrate for the brain?
- Are there any signs of trauma?
- Are there any signs of intoxication?

Initial approach to the patient with AMS

- Airway
- Breathing
- Circulation
- Disability
- Glasgow Coma Scale
- Toxidromes
- SAMPLE history

History and Physical

- Pay attention to all vital signs very carefully
- Do an extensive, careful physical exam - especially the neurological exam
- Do a history of present illness and document the important past medical history – Bring meds if possible

Glasgow Coma Scale

Glasgow coma scale		Score
Eye opening	spontaneously	4
	to speech	3
	to pain	2
	none	1
Verbal response	orientated	5
	confused	4
	inappropriate	3
	incomprehensible	2
	none	1
Motor response	obeys commands	6
	localises to pain	5
	withdraws from pain	4
	flexion to pain	3
	extension to pain	2
	none	1
Maximum score		15

		Activity	Best response	Score
		Glasgow Coma Scale Modified for Children	Eye opening	Spontaneous
To speech				3
To pain				2
None				1
Verbal	Oriented * (coos, babbles)			5
	Confused * (irritable cries)			4
	Inappropriate words * (cries to pain)			3
	Nonspecific sounds * (moans to pain)			2
	None			1
Motor	Normal spontaneous movements			6
	Localizes pain * (withdraws to touch)			5
	Withdraws to pain			4
	Abnormal flexion-decorticate rigidity		3	
	Abnormal extension-decerebrate rigidity		2	

Prehospital Interventions

- Supplemental oxygen
- Evaluate and if needed establish airway
- Ventilate as indicated
- IV access
- Fluids
- Dextrose
- Narcan

Laboratory Evaluation

- Bedside blood glucose
- I-stat: Blood gas, electrolytes, Hgb, Glu
- CMP includes LFTs
- Calcium, magnesium
- CBC with diff +/- blood culture
- UA, UCx
- Ammonia

Laboratory Evaluation

- Drug screen – Urine, serum
- Salicylate level
- Acetaminophen level
- Carboxyhemoglobin level
- Consider LP if indicated

Radiologic Exam

- CT
- CTA
- MRI
- MRA

AMS Neuro-radiology and LP

Brain Lab and Radiologic workup

Evaluation:

- CT
- MRI
- LP – after CT to rule out mass effect

Metabolic

- Oxygen
- Glucose
- Fluids
- Electrolytes
- Correct temperature abnormalities

Toxins/Antidotes

- Nalaxone (Narcan)
- Prevents or reverses opioid effects (hypotension, respiratory depression, sedation), possibly by displacing opiates from their receptors. Half-life is 1 h.
- 0.1mg/kg/dose or > 5 years 2 mg/dose IV/IM
- May be repeated in 1- to 2-min intervals following IV use
- Not to exceed 10 mg cumulative dose

Toxins/Antidotes

- Glucose give 2.5 cc/kg D10
- May try drug specific reversal agents
 - Flumazenil
 - Physostigmine
- Decontamination
- Supportive care

Mnemonic

Vowel TIPS A-E-I-O-U-T-I-P-S

- A
 - Alcohol
 - Abuse
- E
 - Electrolytes
 - Epilepsy
 - Endocrine
 - Encephalopathy

Mnemonic

Vowel TIPS A-E-I-O-U-T-I-P-S

- I
 - Insulin
 - Intussusception
 - Infection
- O
 - Oxygen
 - Opiates
 - Overdose

Mnemonic

Vowel TIPS A-E-I-O-U-T-I-P-S

- U
 - Uremia
- T
 - Trauma
 - Toxicology
 - Tumor

Mnemonic

Vowel TIPS A-E-I-O-U-T-I-P-S

- I
 - Inborn errors of metabolism
- P
 - Psychiatric
 - Post ictal state

Mnemonic

Vowel TIPS A-E-I-O-U-T-I-P-S

- S
 - Shock
 - Seizures
 - Stroke
 - Shunt
 - Space occupying lesions

Summary AMS – Critical Analysis

- Is it a brain problem?
- Is it a substrate problem?
- Is it a toxin/drug?
- Is it environmental or temperature related?
- Could it be intussusception?
- Is it psychiatric?

Summary - History

- Was the change in mental status acute or gradual?
- What events and ROS preceded the AMS?
- What is the Past Medical History?

Summary - Physical

Careful Physical exam

- Detailed neurologic exam
- Meticulous attention to vital signs

Summary - Management

- Primary survey ABCDE
- Resuscitate and stabilize
- Give Oxygen
- Give Glucose
- Give Narcan
- Correct any temperature related problems
 - Tylenol – Cooling measures
 - Warming

Summary

- Look for intoxication/toxidromes
- Laboratory Evaluation
- Radiological Evaluation
- Psychiatric Evaluation