Altered Mental Status
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Terminology
ALTERED MENTAL STATUS...

is not a diagnosis in and of itself

is due to an underlying disease process
Lethargic
Depressed consciousness resembling a deep sleep from which a patient can be aroused but into which they immediately return

Normal
GCS 15

AMS
GCS <15 but >3

Coma
GCS 3

Obtunded = Stuporous
Not totally asleep but demonstrates greatly diminished responses to external stimuli

Coma
A transient state of complete unawareness and unresponsiveness
IRRITABILITY
The state of being abnormally responsive to slight stimuli

DELIRIUM
Acute confusional state characterized by confusion, disordered speech and hallucinations
Differential Diagnosis
Alcohol
Encephalopathy, Electrolytes
Insulin, Intussusception
Overdose
Uremia

Trauma
Infection
Psychiatric
Seizure, Shock, Stroke
PRIMARY CNS DISORDERS

Focally affect the brain by exerting external pressure (bleed/mass) or causing elevated ICP
SYSTEMIC ABNORMALITIES

1. Alter neural activity through decreased availability of substrates (hypotension, oxygen, glucose)
2. Altered intracellular metabolism (hypo/hyperthermia)
3. Introducing extraneous toxins (ingestions, liver/kidney failure)
4. Other conditions (lupus, Wilson’s)
**HYPOXIA**

Hypercapnia cerebral vasodilation and increased CBF

Hypocapnia cerebral vasoconstriction and decreased CBF

CBF can increase 2-fold during periods of hypoxia

O2 sat ≠ cerebral oxygen delivery
HYPOXIA

Mild symptoms
Difficulties with complex learning tasks
Reductions in short-term memory

Moderate symptoms
Cognitive and motor disturbances

Severe symptoms
Fainting, coma, seizures, cessation of brain stem reflexes, and brain death
HYPOGLYCEMIA

Autonomic symptoms
Glucose 40 - 70 mg/dL
Sweating, weakness, tachycardia, tremor, and feelings of nervousness and/or hunger

Neuroglycopenia
10 - 50 mg/dL
Lethargy, irritability, confusion, uncharacteristic behavior, hypothermia, seizure and coma
HYPOTHERMIA

Mild  32-35°C (90-95°F)
Peripheral signs
Consciousness is typically preserved
HYPOTERMIA

Moderate  28-32°C (82-90°F)
Slurred speech, clumsy, agitated and impaired thinking
Confusion and lethargy as core body temp drops
HYPOTHERMIA

Severe hypothermia \( \leq 28^\circ C (82^\circ F) \)

No more shivering - muscle rigidity and flushed skin

Stupor then coma with fixed and dilated pupils
HYPERTHERMIA

Children with heat exposure and elevated body temperature (≥40°C [104°F]) with CNS abnormalities should be treated as victims of heat stroke.

CNS symptoms

Impaired judgment, inappropriate behavior, delirium, hallucinations, ataxia, dysarthria, or coma.
INFECTIONS

Lead to global CNS dysfunction

Meningitis, encephalitis, focal infections

Antibiotics and antivirals

M. pneumoniae, C. pneumoniae and EBV can cause severe impairment of mental status with or without meningoencephalitis
Many drugs can cause AMS
## TOXINDROMES

<table>
<thead>
<tr>
<th>Toxidrome</th>
<th>Mental status</th>
<th>Pupils</th>
<th>Vital signs</th>
<th>Other manifestations</th>
<th>Examples of toxic agents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sympathomimetic</td>
<td>Hyperalert, agitation, hallucinations, paranoia</td>
<td>Mydriasis</td>
<td>Hyperthermia, tachycardia, hypertension, widened pulse pressure, tachypnea, hyperpnea</td>
<td>Diaphoresis, tremors, hyperreflexia, seizures</td>
<td>Cocaine, amphetamines, cathinones, ephedrine, pseudoephedrine, phenylpropanolamine, theophylline, caffeine</td>
</tr>
<tr>
<td>Anticholinergic</td>
<td>Hypervigilance, agitation, hallucinations, delirium with mumbling speech, coma</td>
<td>Mydriasis</td>
<td>Hyperthermia, tachycardia, hypertension, tachypnea</td>
<td>Dry flushed skin, dry mucous membranes, decreased bowel sounds, urinary retention, myoclonus, choreoathetosis, picking behavior, seizures (rare)</td>
<td>Antihistamines, tricyclic antidepressants, cyclobenzaprine, orphenadrine, antiparkinson agents, antispasmodics, phenothiazines, atropine, scopolamine, belladonna alkaloids (eg, Jimson Weed)</td>
</tr>
<tr>
<td>Hallucinogenic</td>
<td>Hallucinations, perceptual distortions, depersonalization, synesthesia, agitation</td>
<td>Mydriasis (usually)</td>
<td>Hyperthermia, tachycardia, hypertension, tachypnea</td>
<td>Nystagmus</td>
<td>Phencyclidine, LSD, mescaline, psilocybin, designer amphetamines (eg, MDMA [&quot;Ecstasy&quot;], MDEA)</td>
</tr>
<tr>
<td>Opioid</td>
<td>CNS depression, coma</td>
<td>Miosis</td>
<td>Hypothermia, bradycardia, hypotension, apnea, bradypnea</td>
<td>Hyporeflexia, pulmonary edema, needle marks</td>
<td>Opioids (eg, heroin, morphine, methadone, oxycodone, hydromorphone), diphenoxylate</td>
</tr>
<tr>
<td>Sedative-hypnotic</td>
<td>CNS depression, confusion, stupor, coma</td>
<td>Miosis (usually)</td>
<td>Hypothermia, bradycardia, hypotension, apnea, bradypnea</td>
<td>Hyporeflexia</td>
<td>Benzodiazepines, barbiturates, carisoprodol, meprobamate, glutethimide, alcohols, zolpidem</td>
</tr>
<tr>
<td>Cholinergic</td>
<td>Confusion, coma</td>
<td>Miosis</td>
<td>Bradycardia, hypertension or hypotension, tachypnea or bradypnea</td>
<td>Salivation, urinary and fecal incontinence, diarrhea, emesis, diaphoresis, lacrimation, GI cramps, bronchoconstriction, muscle fasciculations and weakness, seizures</td>
<td>Organophosphate and carbamate insecticides, nerve agents, nicotine, pilocarpine, physostigmine, edrophonium, bethanechol, urecholine</td>
</tr>
<tr>
<td>Serotonin syndrome</td>
<td>Confusion, agitation, coma</td>
<td>Mydriasis</td>
<td>Hyperthermia, tachycardia, hypertension, tachypnea</td>
<td>Tremor, myoclonus, hyperreflexia, clonus, diaphoresis, flushing, trismus, rigidity, diarrhea</td>
<td>MAOIs alone or with: SSRIs, meperidine, dextromethorphan, TCAs, L-tryptophan</td>
</tr>
</tbody>
</table>

CNS: central nervous system; LSD: lysergic acid diethylamide; MAOI: monoamine oxidase inhibitor; SSRI: serotonin reuptake inhibitor; TCA: tricyclic antidepressant.

*Up To Date: Emergency department evaluation of acute onset psychosis in children*
PSYCHIATRIC CAUSES

Unless there is a past history of the exact same behavior it is dangerous to assume that the cause of AMS is psych

Differential is broad

Medical > psych

If unsure do a workup
PSYCHIATRIC CAUSES

Acute onset psychosis

- Disruption in thinking, accompanied by delusions or hallucinations
- **Delusions** false, fixed beliefs that cannot be resolved through logical argument
- **Hallucinations** false perceptions that have no basis in external stimuli
**PSYCHIATRIC CAUSES**

Patients may feign unconsciousness

Catatonic patients preserve ability to maintain posture

‘Fakers’ usually:
- Avoid hitting their face with a falling arm
- Resist eyelid opening
- Raise HR to auditory or painful stimuli
- Intact DTR, oculovestibular and oculocephalic reflexes
PSYCHIATRIC CAUSES

Brief hallucinations can occur in “normal” situations:

• Falling asleep and waking
• Bereavement
• Sleep deprivation
• Caffeine
<table>
<thead>
<tr>
<th>Evaluation feature</th>
<th>Organic psychosis</th>
<th>Psychiatric psychosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onset</td>
<td>Acute</td>
<td>Gradual</td>
</tr>
<tr>
<td>Pathologic autonomic signs</td>
<td>May be present</td>
<td>Absent</td>
</tr>
<tr>
<td>Vital signs</td>
<td>May be abnormal</td>
<td>Normal</td>
</tr>
<tr>
<td>Orientation</td>
<td>Impaired</td>
<td>Intact</td>
</tr>
<tr>
<td>Recent memory</td>
<td>Impaired</td>
<td>Intact</td>
</tr>
<tr>
<td>Intellectual ability</td>
<td>May be impaired</td>
<td>Intact</td>
</tr>
<tr>
<td>Hallucinations</td>
<td>Visual</td>
<td>Auditory</td>
</tr>
</tbody>
</table>

*Children with both functional and organic psychoses will have impaired reality testing, inappropriate affect, thought disorder, poor behavior control, and disturbed relating ability.

*Increase or decrease in heart rate, respiratory rate, blood pressure, and temperature; miosis or mydriasis; and skin color changes.
LIFE THREATENING CAUSES OF AMS

- Epidural hematoma
- Cerebral edema
- Bain neoplasms
- Cerebral infarctions
- CSF shunt malfunction
- Meningitis/encephalitis
- Toxic ingestions
- Hypotension
- Hypoxia
- Sepsis
Management
Problem with ABCs?

Need meds or fluids now?

Meet any of the following criteria?
• Intubated or apnea
• CPR
• Severe respiratory distress
• SpO2 < 90%
• Acute mental status changes
• Unresponsive?
YOUR JOB

Rapid cardiopulmonary assessment

Secondary survey with attention to pupils, GCS, mental status and signs of trauma
A general approach to the assessment and management of Altered Mental Status
Your assessment should include interventions needed to address ABC related problems
AIRWAY

Assess for potency and ability to maintain

Watch for deterioration

RSI for intubation
BREATHING

Ventilation may be impaired by declining respiratory drive or muscle dysfunction

Goal $O_2$ sat $>95\%$

Use ETCO$_2$

Intubate those who cannot sustain adequate oxygenation or ventilation
CIRCULATION

Continuous EKG monitoring

Assess for perfusion and identify shock

IV for any patient with abnormal VS
DISABILITY

GCS - repeat as patient changes

Pupil exam
Pupil response is the most direct “window to the brain”

Conditions affecting the brain diffusely spare pupils - except for opiates
Will the result alter the approach to treatment?

Will it return in time to affect therapy positively?
ISTAT +/- Accucheck

Renal panel
Osmolality

Acetaminophen
Salicylate
Ethanol
Urine Drug Screen

βhCG
Ingestions are *usually* symptomatic by 4-6 hours except in acetaminophen ingestions.

Sporer et al *Am J Emerg Med*, 1996: Retrospective review of 1820 patients with SI or AMS with suspected ingestion - 0.3% had toxic APAP levels not suggested by history, none required NAC.

Chan et al *Hum Exp Toxicol* 1995: Retrospective review of 294 Chinese patients, 4/208 with suspected APAP poisoning had elevated but non-toxic levels.

In the absence of history however, still get one.

If elevated then repeat at 4 hours.
SALICYLATE LEVEL

Obtain in the unknown ingestion with AMS

Done nomogram no longer routinely used

Levels > 90-100 mg/dL are usually associated with severe toxicity

May need multiple determinations in massive ingestions or sustained release preparations
Elimination follows zero order kinetics

Rate varies 12-25 mg/dL/h - naive drinkers
10 mg/dL/h

Rough correlation between level and symptoms

Level <300 mg/dL in a comatose patient should prompt search for another cause
Urine metabolites can be seen for 2-3 days

Blood 6-12 hours

Does a toxicology screen affect the management of a patient who has taken overdose?

Even if positive it rarely alters management
Brett *Arch Intern Med*, 1988
Belson *Pediatr Emerg Care*, 1999
Sugarman *Pediatr Emerg Care*, 1997

Go ahead and order one, but don’t base your management on it.
EKG Can show block with digitalis or other cardioactive drugs

Diagnostic for serious TCA overdose with QRS widening (≥0.10 sec) & rightward shift of the terminal 40 ms of the frontal plane QRS complex vector (terminal R wave in aVR)
QRS $\geq 100$ ms
Terminal R wave $>3$ mm
R/S ratio $>0.7$

QRS $\geq 100$ msec
Terminal R wave $>3$ mm
R/S ratio $>0.7$
μ-opioid receptor competitive antagonist

Give in suspected opiate overdose

IV, IM, IN or SQ

 Doesn’t save lives - just prevents procedures
OTHER ANTIDOTES

Don’t give flumazenil for benzodiazepine OD - precipitates seizures

Physostigmine may transiently improve MS in anticholinergic ingestion

Diphenhydramine for phenothiazine dystonia
If you suspect meningitis/encephalitis

Stable enough?

Is sedation necessary and safe?
Any acute **coma** of unknown etiology

- Elevated ICP
- Trauma
- CSF shunt
- Focal neuro findings
- Unsupervised child
ANTIBIOTICS

Little harm in giving ceftriaxone +/- vancomycin +/- acyclovir

Try to delay until after LP
PHYSICAL RESTRAINTS

Need regular reassessments and appropriate documentation
CHEMICAL RESTRAINTS

Diphenhydramine, hydroxyzine, lorazepam, midazolam, haloperidol, ziprasidone

PO meds can have similar onset to IM

Other interventions first
<table>
<thead>
<tr>
<th>Medication</th>
<th>Initial dose</th>
<th>Onset of action (min)</th>
<th>Half-life, $t_{1/2}$ (h)</th>
<th>Comments/adverse effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diphenhydramine</td>
<td>1.25 mg/kg&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5–15 (IM/IV)</td>
<td>2–8</td>
<td>Paradoxical reaction&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Teen: 50 mg</td>
<td>20–30 (PO)</td>
<td>2–8</td>
<td></td>
</tr>
<tr>
<td>Hydroxyzine</td>
<td>1.25 mg/kg&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5–15 (IM/IV)</td>
<td>7–10</td>
<td>Paradoxical reaction&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Teen: 50 mg</td>
<td>20–30 (PO)</td>
<td>7–10</td>
<td></td>
</tr>
<tr>
<td>Lorazepam</td>
<td>0.05–0.1 mg/kg&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5–15 (IM/IV)</td>
<td>12</td>
<td>Paradoxical reaction&lt;sup&gt;a&lt;/sup&gt;; respiratory depression</td>
</tr>
<tr>
<td></td>
<td>Teen: 2–4 mg</td>
<td>20–30 (PO)</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Midazolam</td>
<td>0.05–0.15 mg/kg&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5–15 (IM/IV)</td>
<td>3–4</td>
<td>Paradoxical reaction&lt;sup&gt;a&lt;/sup&gt;; respiratory depression</td>
</tr>
<tr>
<td></td>
<td>Teen: 2–4 mg</td>
<td>20–30 (PO)</td>
<td>3–6</td>
<td></td>
</tr>
<tr>
<td>Haloperidol&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.1 mg/kg&lt;sup&gt;b&lt;/sup&gt;</td>
<td>15–30 (IM)</td>
<td>21</td>
<td>EPS/NMS; transient hypotension, may prolong QT&lt;sub&gt;c&lt;/sub&gt;</td>
</tr>
<tr>
<td></td>
<td>Teen: 2–5 mg</td>
<td>30–60 (PO)</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Risperidone&lt;sup&gt;d&lt;/sup&gt;</td>
<td>&lt;12 yr: 0.5mg</td>
<td>45–60 (PO)</td>
<td>20</td>
<td>EPS/NMS may prolong QT&lt;sub&gt;c&lt;/sub&gt;</td>
</tr>
<tr>
<td></td>
<td>Teen: 1 mg</td>
<td>45–60 (PO)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Olanzapine&lt;sup&gt;e&lt;/sup&gt;</td>
<td>&lt;12 yr: 2.5 mg</td>
<td>30–60 (IM)</td>
<td>30</td>
<td>EPS/NMS may prolong QT&lt;sub&gt;c&lt;/sub&gt;</td>
</tr>
<tr>
<td></td>
<td>Teen: 5–10 mg</td>
<td>45–60 (PO)</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Quetiapine</td>
<td>25 mg</td>
<td>45–60 (PO)</td>
<td>6</td>
<td>EPS/NMS may prolong QT&lt;sub&gt;c&lt;/sub&gt;</td>
</tr>
<tr>
<td>Ziprasidone</td>
<td>&lt;12 yr: 5 mg</td>
<td>30–60 (IM)</td>
<td>2–5</td>
<td>EPS/NMS may prolong QT&lt;sub&gt;c&lt;/sub&gt;</td>
</tr>
<tr>
<td></td>
<td>Teen: 10–20 mg</td>
<td>60 (PO)</td>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

IM, intramuscular; IV, intravenous; PO, oral; EPS, extrapyramidal symptoms; NMS, neuroleptic malignant syndrome.

<sup>a</sup>A paradoxical reaction, such as behavioral disinhibition, agitation, hyperexcitability, and insomnia may occur.

<sup>b</sup>Round dose to nearest milligram or half milligram.

<sup>c</sup>Although not U.S. Food and Drug Administration approved, haloperidol lactate has been used IV (with dosage usually approximated at PO dose $\times 0.625$).

<sup>d</sup>Relative risk for QTc prolongation: ziprasidone > quetiapine > risperidone, olanzapine, haloperidol.

<sup>e</sup>Rapidly disintegrating oral tablet available.

<sup>f</sup>Liquid formulation available.
Take Home Points
Altered mental status is usually caused by an underlying disease process.
ABC > IV > glucose + labs > CT > LP
Even with a past history of mental health illness acute onset psychosis is more commonly associated with an underlying medical cause.
Altered Mental Status