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How to encounter the child in coma

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ABSTRACT

Non-traumatic coma is a medical emergency and should be evaluated as soon as possible. Pediatric coma is more serious because of patient's capacity of pathological stressor tolerance is limited especially in neonates. Several etiologies could be listed for loss of consciousness (LOC) and coma in childhood. According to the epidemiological studies, causes of coma are different all around the world. Glasgow Coma Scale has been used for coma scaling. In this review, we focused on some highlight causes of coma in pediatric medicine.

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Introduction

Comatose child almost always refers to the pediatric emergency unit (1). Many reports showed that encounter with these situations need good level of critical care knowledge and good level of professional clinical practice (2,3).

Level of consciousness in children is a very important question with difficult answer (4). Coma refers to a state of complete unawareness and unresponsiveness (5). One of the most important scales for the assessment of neurologic conditions is the Glasgow Coma Scale (Table 1) (6). Some etiologies and diagnosis of acute childhood comatose are listed in Table 2 and 3 (5).

Differential diagnosis for children presenting with coma or altered level of consciousness is very important for any pediatrician (7-9).

Pathophysiology of coma

Brainstem and pons have important role in

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our consciousness; they modulate cortical signals for other downstream targets of central nervous system (CNS) (10).

Ascending reticular activating system (ARAS) is responsible for awareness. Good function of the ARAS and brain hemispheres depends on many factors, including the presence of substrates needed for energy production, adequate blood flow to deliver these substrates, maintenance of normal body temperature, absence of abnormal serum concentrations of metabolic wastes elements or exogenous toxins, and the absence of CNS infection or seizure with abnormal neuronal activity (11).

Table1. Glasgow Coma Scale in Pediatric Medicine

Eye Opening		**score**
Spontaneous		4
To speech		3
To pain		2
None		1
Best Motor Response		
Obeys verbal command		6
Localizes to painful stimulus		5
Flexion withdrawal		4
Flexion decorticate		3
Extension decerebrate		2
No response		1
Best Verbal Response		
year 5<	**year 5 >**	
Oriented, converses	Alert, babbles, coos, words or sentences normal	5
Disoriented, converses	Less than usual ability, irritable cry	4
Inappropriate words	Cries to pain	3
Incomprehensible sounds	Moans to pain	2
No response	No response to pain	1
Preverbal children should receive full verbal score for crying with stimulation.		

Table2. Etiology and diagnosis of acute childhood comatose (Central Nervous System Diseases)

Trauma	Intracranial hematoma (subdural, epidural, intraparenchymal)
	Cerebral contusion
	Cerebral edema
	Concussion
Seizures	Status epilepticus (convulsive, nonconvulsive)
	Postictal state
Infection	Meningitis
	Encephalitis
	Focal infections (brain abscess, subdural empyema, epidural abscess)
Neoplasm	Tumor (edema, hemorrhage)
Vascular disease	Cerebral infarct (thrombotic, hemorrhagic, embolic)
	Central venous thrombosis
	Subarachnoid hemorrhage
	Vascular malformation/ aneurysm
Hydrocephalus	Obstructive (from tumor or other cause)
	Cerebrospinal fluid shunt malfunction

Non-traumatic Coma

CNS infection

Meningitis, encephalitis, or other types of CNS infection may cause coma in a child (12,13). Inflammation of the brain might be due to infections and this condition should be seriously considered because of unexpected results (14). Despite the fact that Haemophilus influenza and Streptococcus pneumoniae vaccines are available, bacterial infection is still a common cause of loss of consciousness (LOC), but other microorganisms can involve in LOC (15). Enteroviruses and Herpes viruses could cause viral encephalitis. Most of the time, fungal infections or parasitic infections (toxoplasmosis, etc.) have a slower onset of symptoms (16). Focal infections (brain

abscess, subdural empyema, epidural abscess) could induce focal seizure and may lead to LOC (17).

Malignancy

Direct invasion of the ARAS by the malignancies such as hematologic malignancy with CNS involvement may cause LOC (18) which may be due to increase in intracranial pressure, seizure (19) or brain hemorrhage. Lethargy and vomiting are some of the signs and symptoms in brain malignancy involvement (20).

Vascular cause

Cerebrovascular origin of coma is important for patient's management. Three types of etiology interrupt cerebral blood flow including brain hemorrhage, thrombosis and embolism (21). Arteriovenous malformation (AVM), aneurysm, and cavernous hemangioma are structural abnormalities which cause brain hemorrhage (22,23). They may lead to the spontaneous intracranialhemorrhage and LOC (23).

Table 3. Etiology and diagnosis of acute childhood comatose (Conditions Affecting the Brain)

Vital sign abnormalities	Hypotension, hypertension Hypothermia, hyperthermia
Hypoxia	Pulmonary disease Severe anemia Methemoglobinemia Carbon monoxide Posthypoxic encephalopathy
Intoxications	Sedative drugs: antihistamines, barbiturates, benzodiazepines, ethanol, gamma-hydroxybutyrate (GHB) and analogs, narcotics, phenothiazines Tricyclic antidepressants Anticonvulsants Salicylates
Metabolic abnormalities	(Hypoglycemia (sepsis, insulin overdose, ethanol intoxication Hyperglycemia (diabetic ketoacidosis, hyperglycemic hyperosmolar syn-(drome Metabolic acidosis Metabolic alkalosis Hyponatremia, hypernatremia Hypocalcemia, hypercalcemia Hypomagnesemia, hypermagnesemia Hypophosphatemia (Uremia (kidney failure Liver failure (Acute toxic encephalopathy (Reye's syndrome Inherited metabolic disorders
Others	Intussusception Hemolytic uremic syndrome Dehydration Sepsis (Rheumatologic conditions (SLE, Behçet's Psychiatric conditions

Ischemic stroke occurs due to thrombosis or embolism. Stroke usually may cause focal neurological deficit, not coma (24). Brain hemorrhage and parenchymal swelling could lead to raised ICP (25) and make ARAS blood flow deficiency.

Consequently, this deficiency leads to LOC (26).

Toxic Ingestions

Pediatric toxic ingestion or accidental poisoning is a very common chief complaint in pediatric emergency unit (27,28). Toxin ingestion could be unintentional or intentional (29).Body packing is one of the child abuses and may be a cause of coma that should be considered (30). Special epidemiological surveillance in any region is important and necessary (28). Some toxin may cause coma or LOC due to several pathophysiology.

Serum metabolites and substrate

Abnormal serum levels of substrates or metabolites could lead to the LOC and coma. Hypoglycemia, metabolic acidosis or alkalosis, abnormal serum electrolyte levels (Na, K, Ca, P and Mg) are some of the main causes of serum substrate abnormalities which may lead to LOC (31,32). Renal and hepatic failure may result in progressive apathy, confusion and coma (33).

Urea cycle deficiency could present with ALOC and hyperammonemia in neonates or young children. Hyperammonemic coma is a result of total enzyme insufficiency (34).

Reye's syndrome is very rare but could induce liver failure and could predispose the patient to delirium that progresses to coma (35).

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Conflict of Interest

The authors declare no conflict of interest.

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