A CHALLENGE FOR SURVIVAL OR DEATH

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- The hardest degree of consciousness is caused by deep depression of CNS.
- Main cause of morbidity and mortality in children.
Definition

- Absence of self awareness and of the environment
- Coma scales: Glasgow, up to 5 years modified James
- Max. number 15, min. 3, score 8 - undesired outcome

Terminology:
- lethargy, somnolence, stupor and coma
<table>
<thead>
<tr>
<th>Answers</th>
<th>Signs</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal answer</td>
<td>Open mouth</td>
<td>1-5</td>
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<td></td>
<td>Cry</td>
<td></td>
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<td></td>
<td>irritability</td>
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<tr>
<td>Motor answer</td>
<td>Abnormal extension or flexion spontaneous movement</td>
<td>1-6</td>
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<tr>
<td>Visual answer</td>
<td>Do not open eyes, opens with pain, spontaneous open</td>
<td>1-4</td>
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There is a variation in the annual rate of incidence for non-traumatic coma according to age.

Highest frequency during the first age of life.
Ethiology

Structural changes:

- **Trauma** (during delivery, commotion-contusion, epidural and subdural hematoma)
- **Neoplasm** (various infiltrations, Tu)
- **Vascular accidents** (cerebral infarction, bleeding, vasculitis, malignant hypertension)
- **Infections**
- **Hydrocephalus**
Metabolic-toxic changes:

- **Hypoxia-ischemia** (perinatal HIE, cardiopulmonary insufficiency, choking, suffocation, strangulation)

- **Metabolic disturbances** (hypoglycemia, electrolytes disturbances, hepatic encephalopathy, inborn errors of metabolism, drugs)

- **Paroxysmal disturbances** (epilepsy, migraine)
Pathophysiology

- Normal condition of the consciousness depends on the normal function of the cerebral hemisphere and RES which is diffusely scattered and undefined scattered neurons responsible for the condition of awareness.

- Depends on the concentration of the glucose and oxygen.

- Blood flow must be normal as well as the intracranial pressure.
Background
- Time of onset
- apoplectic-seizures-vascular accident
- acute: drugs, poisons, toxins
- gradually: metabolic disturbances, infections

Associated symptoms
- Temperature - Reye syndrome
- Infections: bacterial and viral
- Tu cerebri
- AVM, hydrocephalus
- Headache

Trauma
A. Encephalopathy
- hypoxia
- ischemia
- seizures and other postictal conditions
- metabolic: hypoglycemia, Reye syndrome

B. Infections
- encephalitis
- meningitis
- septicemia

C. Conditions of increased intracranial pressure
- cerebral edema
- hydrocephalus
- tumors
D. Vascular accidents:
- **Bleedings**: extramural, subdural, subarachnoid, intra-ventricular
- Hypertensive encephalopathy

E. Conditions of other organs:
- hepatic coma
- uremic encephalopathy
- respiratory insufficiency with CO2
- endocrine
F. Exogenous intoxications:
- sedatives
- salicilates
- hard metals
- CO

G. Electrolytes and gas analyses
- H₂O, Na, K, Mg and Ca

H. Trauma
ALGORITHM FOR COMATOSE CHILD

- Malignant diseases and immunosuppressant
- Bleeding caused by blood disturbances
- Chronic heart diseases
- Sepsis
- Brain abscess
- Uremia
- Diseases of the liver, urea cycle disturbances
- Diabetes mellitus and diabetes insipidus
- Epilepsy
- Endocrine changes
- Inborn error of metabolism
Jolting of the head during comatose condition
Respirations:

- **Cheynes Stokes breathing:**
  - Trauma of the brain hemisphere
  - Metabolic disturbances

**Hyperventilation**
  - Lesion of tegmentum
  - Various causes of metabolic variation (like Sy Rey)
  - Hypoxia

**Irregular breathing rhythm**
  - Lesion of pons and medula oblongata

- **Apnea**
  - Lesions of cervicomедular connection
KVS:

- Hypertension
- Hypotension
- Tachycardia
- Bradycardia
- Diuresis
Body temperature

- **Hypothermia** (chocking, barbiturate poisoning, alcohol, cooling)
- **Hyperpyrexia** (infections, meningoencephalitis, sepsis)
- Overheating
- Heat stroke
Skin and breath

- Echimosis, hematoma (meningococccial sepsis, leucosis, trauma)
- Needle stab (diabetes mellitus, drug addiction)
- Redness (poisoning with CO, atropine or mercury)
- Acetone odor breath (diabetic ketoacidosis)
- Earthly like odor (hepatic coma)
- Urine odor breath (uremic coma)
Clinical assessment

- **ABCD**
- **Consciousness condition**: awareness, eye focus and orientation
- **Cranial nerves:**
  - Pupil dilatation and reaction on light (2\textsuperscript{nd} cranial nerve)
  - Unilateral dilated pupil-lesion of mesencephalon
  - Reactive pupil big as needle-lesion of pons
  - Extra ocular movements (3, 4 and 6 cranial nerves)
  - Corneal reflex (5 and 7 cranial nerves)
Clinical assessment

- **Motor answers**
  - Hemiparhesis - unilateral structural lesions
  - Decortical position - disfunction of the brain hemisphere and diencephalon
  - Decerebral position - destructive lesions of mesencephalon and upper part of the pons
Treatment

- Adequate oxygenation, ventilation and circulation
- Gas analysis and electrolyte balance
- Correction of glycaemia
- Monitoring intracranial pressure
- Prevention from seizures
- Therapy for infection
- Lowering of the body temperature
- Sedation
Priority for in-patient care

1. Stabilization prior to transport at NICU or PICU
2. Adequate breathing pathways, than ventilation
3. First correction of the hypovolaemia, than electrolyte and gas balance
4. First stabilization of the circulation, than correction of the increased intracranial pressure
Дополнителни анализи и pregledи:

- KTM
- MRI
- EEG
- Hemokultura, urinokultura, CRP
- CSL
- Laktati, ruvati, CPK, amino kiselini и organski kiselini vo krv и urina
- Funkcionalni testovi и tireoidea
- Evocirani potencijali
COMA VIGILE

Laboratory:
- liquor: negative
- Proteinorhahy: negative
- Hepatogram, electrolite, enzime status, hemoculture: negative
- Viral findings: negative

Consultation:
- Cardiologist
- Infectologist
- Ophtalmologist
- Nephrologist
- Gastroenterologist

Normal range

Therapy:
Antibiotics, antivirostatics (i.v., and per os), corticotherapy (i.v., and per os), plasma, immunoglobulins, antiepileptic drugs (carbamazepine, oxcarbazepine, lamotrigine, difetoin, clonazepam, fenobarbiton, diasepm i.v., sedatives, antiparcinsonics, miorelaxsants), aspirations, hyper energetic and hyper caloric feedings through NG tube.

No improvement
T2 pulse sequence shows normal signal and no signs of focal lesions and intracranial space and brain liquor system is functioning normally.
MRI + flair

Normal
CSL are extended comparing to the one done in the mother country-first stadium atrophy.

After 2 months in Slovenia
Initial signs of disdimielinisation and PVL.

After 2 months in Slovenia
Functional and well developed intracranial arteries and after administration of contrast material there is no pathological development.

After 2 months in Slovenia
Extra pyramidal symptomatology
Transportation vehicle
Inicijalni testovi:

- KKS
- Puls oksimetrija, gasni analizi
- Glikoza, urea, kreatinin, amo
- Funkcionalni testovi na слезина и bubreg
- Metabolen skrining na urina
- Toskikoloшки skrining
Most important!

ABC, oxygen, and mean arterial pressure

- Permanent brain damage is due to:
  1. reduction of cerebral perfusion $\text{CPP} = \text{MAP} - \text{ICP}$
     = brain ischemia = seizures and hypertensive encephalopathy
  2. Differences between the pressure of the upper and lower brain = herniation
What next than?

- Monitoring of the intracranial pressure
- Monitoring of adequate cerebral perfusion pressure
- Managing with intracranial hypertension
- Monitoring of EEG
Persistent vegetative state (PVS)

- Free radicals
- Eksitotoxins
- Ca
- Inflammatory vasculopathy with spasm and occlusion of the cerebral blood vessels

Secondary brain injury
Assessment of possible danger of coma

- 8 months infant
- Brought with ambulance by the father
- He (father) has found the infant at home
- No history of trauma
- In the ER the physician is approaching an infant in tonic position with no cry
You as physician, what would You do at the ETV prior to Hospital?

- Assess the main parameters (T, pulse, perfusion, respiration)
- Give oxygen, protect the airways, put the infant in lateral position
- Administer diazepam intra-rectal
- All of the above
Assessment

- Glasgow coma GCS 4
- P 55/37, pulse 140/min., pO2 could not be measured
- Irregular breathing
- Right pupil 4 mm, left 3 mm
- Cyclic movement of the eyes
- Tensed fontanela
- Tonic seizures
At this point with is your primary care step?

- Emergency CT scan
- Intubation and coping with the seizures
- Administration of i.v. fluid
After intubation the perfusion is getting better.

The infant has received 1 doze intrarectum diazepam 0.5 mg/kg and 2 doses i.v. diazepam 0.3 mg/kg/tt and still has seizures.
What would You give next as antiepileptic therapy?

1. i.v. op per sondam difetoin (fenitoin)
2. i.v. tiopentan
3. One more diazepam
After administration of difetoin what would You check next?

- Glucose level
- Electrolytes
- Blood counts
- Hemostasis
Questions and answers

Would You recommend CT scan?

- Yes
- No
Questions and answers

After careful examination, with no history of trauma, and good condition of the infant prior the coma, with no signs of bleeding, what would you check next?

1. Pupils dilatation
2. Reflexes
3. Fundus oculi
Myths and facts about children with brain damage
Looks good—probably is good

Later ADHD or LD (very often)

Physical recovery is not the same as cognitive recovery
Younger the child
easier the recovery

Immature brain is
more acceptable
to damage
Severe damage means disability

Disability is ranged according to the physical, cognitive, behavioral, social and communicative skills.

All disabilities are not the same.
Time cures.

Time shows.
Modern revolution of medical technology changed many things specially the fact of when, where and how we die and gave medical and spiritual confusion about death.

Ethical dilemmas
“THERE ARE FOUR PHENOMENA OF MIND: THINGS EITHER LOOK AS THEY APPEAR TO BE OR THEY ARE NOT AND NEITHER APPEAR TO BE OR THEY ARE BUT THEY APPEAR NOT TO BE OR THEY ARE NOT BUT THEY APPEAR TO BE.

THE WISE MAN’S TASK IS TO FIND OUT WHICH OF ALL OF THEM ARE WHAT THEY REALLY APPEAR TO BE.”

EPICICTETUS, II Cent. B.C.