UNIVERSITATEA DE STAT DE MEDICINĂ ȘI FARMACIE
“NICOLAE TESTEMIȚANU” DIN REPUBLICA MOLDOVA

Febrile syndrome and febrile convulsions

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Febrile syndrome
Generalities

- The central temperature of human beings is, as in another animals with warm blood, a constant, which is naming **homeothermia**, in contrast with that of animals with cold blood (fish, reptiles, etc.) which is variable.

Febrile syndrome
Generalities

- Homeothermia results from equilibrium between warmth production, or **thermogenesis** (alimentation, physical exercise…), and the means to combat it, or **thermolysis** (more or less abundant sweating, water intake).
- There are, however, variations of central temperature during one day by 0,6ºC, the most decreased temperature being registered in morning and the most increased evening.

Febrile syndrome
Generalities

- It’s important to memorize that, normally, the children seems to have a temperature slightly more that the normal temperature of adults, and can sometimes achieve until 38ºC, and even 38,5ºC in evening.

Febrile syndrome

Generalities

- Temperature is ultimately regulated in the **hypothalamus**. A trigger of the fever, called a pyrogen, causes a release of **prostaglandin E2** (PGE2). PGE2 then in turn acts on the hypothalamus, which generates a systemic response back to the rest of the body, causing heat-creating effects to match a new temperature level.

Febrile syndrome

Generalities

- In many respects, the hypothalamus works like a **thermostat** When the set point is raised, the body increases its temperature through both active generation of heat and retaining heat. **Vasoconstriction** both reduces heat loss through the skin and causes the person to feel cold. If these measures are insufficient to make the blood temperature in the brain match the new setting in the hypothalamus, then shivering begins in order to use muscle movements to produce more heat. When the fever stops, and the hypothalamic setting is set lower; the reverse of these processes (vasodilation, end of shivering and nonshivering heat production) and sweating are used to cool the body to the new, lower setting.

Hypothalamus

- The brain ultimately orchestrates heat effector mechanisms via the **autonomic nervous system**. These may be:
- Increased heat production by increased muscle tone, shivering and hormones like **epinephrine** (adrenaline)
- Prevention of heat loss, such as vasoconstriction.
- In infants, the autonomic nervous system may also activate brown adipose tissue to produce heat (non-exercise-associated **thermogenesis**, also known as non-shivering thermogenesis). Increased heart rate and vasoconstriction contribute to increased **blood pressure** in fever.

Usefulness

- There are arguments for and against the usefulness of fever, and the issue is controversial. There are studies using warm-blooded vertebrates and humans *in vivo*, with some suggesting that they recover more rapidly from infections or critical illness due to fever. A Finnish study suggested reduced mortality in bacterial infections when fever was present.
- In theory, fever can aid in host defense. There are certainly some important immunological reactions that are sped up by temperature, and some pathogens with strict temperature preferences could be hindered.

Usefulness

- Research has demonstrated that fever assists the healing process in several important ways:
- Increased mobility of leukocytes
- Enhanced leukocyte phagocytosis
- Endotoxin effects decreased
- Increased proliferation of T cells

The thermic metabolism in newborns

- Insufficient thermoproduction.
- Incapacity to increase the thermic losses in the case of hyperthermia and the thermoproduction in the case of overcooling.
- Incapacity to present a typical febrile reaction (caused by insufficient sensibility of hypothalamic neurons to the pyrogenic leucocytary substances and increased concentration of arginin-vasopressin which decreases the body temperature).
- Only at the age of 2-3 years the circadian rhythm of body temperature is installing in children.

The forms and basic mechanisms of body t^0 increasing

- We speak about **fever** when the body temperature is mai more than 38°C. A febrile sensation can appear when the temperature exceeds the medium normal value of 37°C.
- **The febrile state** appears when the function of de thermoregulation centers from hypothalamus is not disturbed, but under the action of pyrogenic substances (exogenous – lipopolysacharides, or endogenous – macrophages, granulocytes, neutrophils, eosinophils, in consequence of phagocytosis the genetically determined "point of body **t**" (*set point*) is changing. The febrile states have a positive biologic character of organism defense.

The forms and basic mechanisms of body t^0 increasing

hyperthermic reaction (t^o higher than 38,0 – 38,5^0 C), which appears on the background of disturbance and decompensation of thermoregulation mechanisms function (intensifying with metabolism decompensation, pathological disorders of thermoregulartion centers.

The **hyperthermic reactions** are often met in pediatric practice, especially in neuroinfections, different viroses etc. and have not biologic sense for organism. They have only pathologic character.

The forms and basic mechanisms of body t^0 increasing

- **Hyperthermia** corresponds to central body temperature increasing provoked by thermogenesis increasing, in the time of some intense muscular exercise, for example, and/or diminishing thermolysis, having a connection with very high exterior temperature, diminishing of sweating and/or insufficiency of hydric intakes (overheating, dehydration, etc).

The forms and basic mechanisms of body t^0 increasing

- Due to hyperthermia all forms of metabolism are decompensating, the endogenous intoxication of organism increases(cascade of intermediary metabolits), the disorders of vital centers – respiratory and cardiovascular are observed, the convulsions appear, the cerebral edema increases.

The forms and basic mechanisms of body t^0 increasing

- The hyperthermic reactions are not stopping with antipyretics, but the physical methods are useful: frictions of body with wet gauze and ensuring of local hypothermia in the region of head and magistral vessels (towels, wet swaddling clothes etc).

Etiology of fever

Infectious causes

- Bacterial infections
- Mycoplasma
- Chlamidias
- Parasitoses
- Mycoses etc.

Etiology of fever

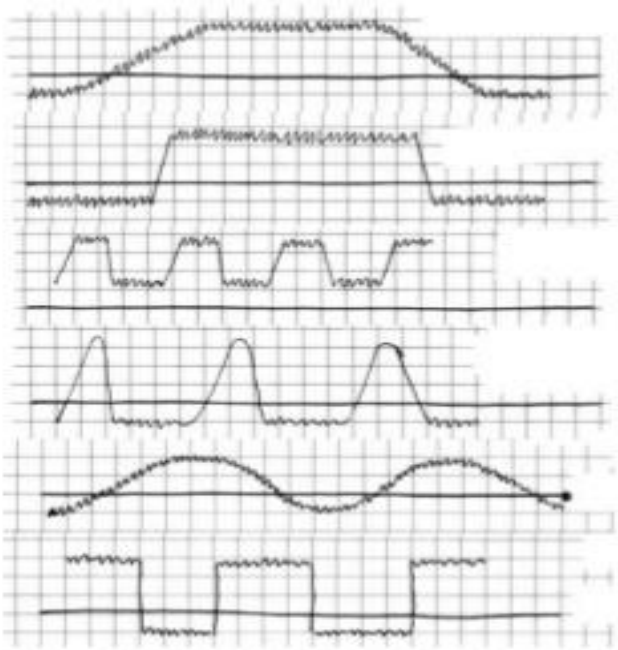
Noninfectious

- Imunopathological (collagenoses, systemic vasculites, allergies)
- Tumors (lymphogranulomatosis, lymphomas, neuroblastomas)
- Intracranial traumas
- Hemorrhages
- Endocrine diseases
- Vaccination
- Malignant hyperthermia etc.

Levels of fever

- Subfebrile (until 38^0C)
- Moderated fever ($38,1^0$C – $39,0^0$C)
- High fever ($39,0^0$C - >)
- Hyperpyrexia (more than 41^0C)

Thermic curves



A

B

C

D

E

F

a) Fever continues
b) Fever continues to abrupt onset and remission
c) Fever remittent
d) Intermittent fever
e) Undulant fever
f) Relapsing fever

https://www.slideshare.net/azadhaleem/fever-in-children-55347622

Thermic curves

- **Continuous fever**– oscillation in 24 hrs no more than 1^0C (abdominal typhus)
- **Remittent fever-** oscillation in 24 hrs more than 1^0C (virotic and bacterial infections)
- **Irregular or atypical fever**– oscillations are irregular– the most frequent form of fever in different pathologies
- **Hectic fever**– correlation between remittent and irregular fever with oscillations more than 2-3 ^{0}C
- **Intermittent fever**– short periods of high temperature which correlates with the periods of physiological temperature (tuberculosis, purulent diseases)
- **Recurrent fever**– the alternation of febrile crisis in the time of 2-7 days with the periods of apyrexia by 1-2 days is characteristic (malaria).

Clinical signs

- **Respiration** – in the first phase of fever the frequence of respiration decreases, then increases with 4 respiratory movements at each degree of fever. In the same time, the volume of respiration not increases, but even decreases being the cause of hypoxia appearance as pathogenetic mechanism of affection in fever.

- **Circulator system:** pulse increasing with 8-10 beats at fever increasing with 1 degree. In the cases of long – term febrile states and manifested with high values the collapse, cardiac failure, DIC syndrome are determining.

Clinical signs

- **The digestive system** is characterizing by motory and fermentative activity decreasing, gastric juice acidity decreasing.

- **Nervous system:** fatigue, headache, delirium, insomnia or somnolence.

Management

- **The diagnosis** is performing on the base of thermometria, clinical manifestations of basic disease and routine paraclinical examinations.

- **The treatment** includes the following measures:
  - ✓Diet
  - ✓Physical methods of cooling
  - ✓Using of antipyretics

Management

- Fever should not necessarily be treated.[30] Most people recover without specific medical attention. Although it is unpleasant, fever rarely rises to a dangerous level even if untreated. Damage to the brain generally does not occur until temperatures reach 42 °C (107.6 °F), and it is rare for an untreated fever to exceed 40.6 °C (105 °F

Conservative measures

- Some limited evidence supports sponging or bathing feverish children with tepid water. The use of a **fan** or air conditioning may somewhat reduce the temperature and increase comfort. If the temperature reaches the extremely high level of **hyperpyrexia**, aggressive cooling is required. In general, people are advised to keep adequately hydrated. Whether increased fluid intake improves symptoms or shortens respiratory illnesses such as the **common cold** is not known.

Medications

- Medications that lower fevers are called *antipyretics*. The antipyretic *ibuprofen* is effective in reducing fevers in children. It is more effective than *acetaminophen* (paracetamol) in children. Ibuprofen and acetaminophen may be safely used together in children with fevers. The efficacy of acetaminophen by itself in children with fevers has been questioned. Ibuprofen is also superior to *aspirin* in children with fevers.

Medications

- Additionally, *aspirin* is not recommended in children and young adults (those under the age of 16 or 19 depending on the country) due to the risk of *Reye's syndrome*.
- Using both paracetamol and ibrupofen at the same time or alternative between the two is more effective at decreasing fever than using only paracetamol or ibuprofen. It is not clear if it increases child comfort.

Febrile convulsions
Definitions

The convulsions are paroxystic or rhythmic or saccadated muscular contractions, enclosed in tonic, clonic or tonico-clonic crises.

The convulsions can have **epileptic** and **nonepileptic** (occasional) origin.

The seconds are released by intercurrent events (fever, metabolic disorders, neuroinfections etc.).

Febrile convulsions

They represent a critical disorders which appear in children between 6 months and 5 years, in association with fever, but without the signs of intracranian infection and without afebrile crises in antecedents.

The majority of crises, until 90%, appear before 3 years age, with the incidence peak at 15 months.

The causes of febrile convulsions

- Infections of nervous system.
- The fever can act as a trigger factor of convulsions.
- Febrile convulsions, as expression of some genetic predisposition connected with the age.

The causes of febrile convulsions

- Most frequently, the crises of febrile convulsions follow the virotic infections ofrespiratory tract, severe gastroenteritis caused by *Shigella* or another infections which provoke minimal fever by $37,8^0 – 38,5\ ^0C$.
- The crises appear usually with the first episode of fever or are the first symptom of fever manifestation in 25 – 42% of cases.

International classification of epilepsies, epileptic syndromes and critical disorders

Localized crises (focal, partial):
I.1. Idiopathic (primary)
I.2. Symptomatic (secondary)
I.3. Criptogenic
Generalized crises:
II.1. Idiopathic
II.2. Symptomatic
II.3. Criptogenic or symptomatic

- Undetermined syndromes(with focal character or generalized undetermined): neonatal crises, myoclonic severe epilepsy of the child, acquired epileptic aphasia , epilepsy with peak – wave complexes continues in the time of sleeping.
- Special syndromes (situational, occasional crises(**febrile convulsions).**

Clinical manifestations

- **Tonic crises**– sudden disturbance of consciousness, hypertonia of axial musculature with the members in extension, apnea, perioronasal cyanosis, contracture of masseters, revulsioned eyes;
- **Tonico-clonic crises** are characterizing by tonic phase with duration of10-12 seconds, followed by clonic phase with muscular symmetrical and bilateral clonus, with short relaxations during until 2 minutes, the tongue wounding can appear, sanguinolent foam, elimination of urine and stools; the resolutive phase is characterizing by postcritical coma with ample, noisy respirations, bilateral midriasis;
- **Atonic crises** – sudden loss of muscular tonus during one or a few seconds, sudden falling of the head on the chest.

Clinical manifestations

- **Atonic crises** – sudden loss of muscular tonus during one or a few seconds, sudden falling of the head on the chest.
- Loss of consciousness authenticated by ocular revulsion .
- **Neuro-vegetative disorders –** respiratory, vasomotory (accesses of pallor), rhythm irregularities, cyanosis.

Simple febrile convulsions

They appear in a child with negative neurologic anamnesis, in the age from 6 months until 5 yrs, on the background of fever, are primarly generalized, have duration until 15 minutes, are not repeated during the same febrile episode or in afebrility.

The relatings about the febrile convulsions in heredo-collateral antecedents are possible.

Complicated febrile convulsions

Duration over 15 minutes, age over 10 months, they can generate convulsive status, are repeating in series in the same day, often are focal, with lateralization, the motory postcritical deficits–Todd paralysis can remain.

They can develop epilepsy in 8 % -15% of cases.

Diagnosis

It is necessary to exclude some infectious diseases with localization at the level of CNS.

This imposes a decision about the performance of some paraclinical investigations, lombar puncture, neuroimagistics, EEG.

Differential diagnosis

The epileptic origin of crises will be sustained in the base of some crises recurrency with stereotip character, without evidence of some trigger factors, with typical changes on E.E.G.

It is made with the following diseases:

- Primary infections of CNS;
- acute encephalopathy;
- syncope;
- febrile delirium;

The treatment

The treatment of febrile convulsions will be performed with usual anticonvulsivants and in specific dosage, as these recommended in the treatment of epileptic status.

The means of body temperature decreasing and the treatment of infection responsable for fever will be associated.

The treatment

- The recommended medication is phenobarbital or valproat, the single anticonvulsivants efficient in febrile convulsions.
- The prophylactic intermittent therapy has however a general acceptation. There are a lot of recommended protocols. But the most often the medication is effectuated with Diazepam per os 0,3 mg/kg, Diazepam rectal 0,5 mg/kg.

The treatment of convulsive status [after *Paul Moe, Alan Seay, 1991*]

1. The primordial measures ABC [A –air; B - breath; C - circulation]:
   - Liberation of respiratory pathways
   - oxygen supply of respiration
   - Maintaining of pulse, AP by optimal perfusion of liquids 20-30 ml/kg.
2. Initial solution- glucose 20% i/v, 1 ml/kg.
3. Monitoring of sanguine gases level, of electrolytes, urea and anticonvulsivants level in blood and of intracranian.

The treatment of convulsive status [after *Paul Moe, Alan Seay, 1991*]

4. Intravenous anticonvulsivant treatment:
- diazepam 0,1-0,3-0,5 mg/kg (20mg) can be repeated after 5-20 min, its maximal action is after 20 min: can provoke respiratoriy depression;
- lorazepam 0,05-0,2 mg/kg (has more prolonged that diazepam action);
- fenitoin (difenin) 10-20 mg/kg;
- phenobarbital 10-20 mg/kg.

5. Correction of metabolic disorders (acidosis, etc.).

The treatment of convulsive status [after *Paul Moe, Alan Seay, 1991*]

6. If the convulsions are repeating again we introduce:

- fenitoin 5 mg/kg and phenobarbital 5 mg/kg; monitoring of their concentration in blood, the respiration and arterial pressure are maintaining in optimal limits;
- i/v paraldehid 4% or per rectrum 0,1-0,3 ml/kg (1:1 with olives oil)
- valproic acid in suspension 30-60 mg/kg per os or per rectum.

7. After exit from convulsive status fenitoin and phenobarbital (5-10 mg/kg) and calcium preparations will be administered.

Prognosis

In febrile convulsions it is este favourable.

- In 70% of cases one self convulsivant episode will exist and only in 9 % of cases more than 3 episodes will exist.
- Increased risk of FC recurrence is more in children until1 year. After 4 years the risk of recurrence is10 %.
- The risk of epilepsy development is 4 times more in a child with febrile convulsions.

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