

**MINISTRY OF PUBLIC HEALTH OF UKRAINE
O.BOHOOLETSNATIONALMEDICALUNIVERSITY**

PEDIATRIC DEPARTMENT N5

"Approved"
on the methodical conference
Department of Pediatrics № 5
protocol №2 from 07.09.2016

**GUIDELINES
FOR STUDENTS**

Academic discipline	Pediatrics
Study subject	Newborn infants: physical development and physiologic characteristics. Temporary states of neonates. Definition of infant's maturity. Physical and physiological characteristics of preterm neonates.
Course	3
Faculty	Medical 1

Kyiv-2016

NEW BORN CHILD. PECULIARITIES OF THE NEWBORN PERIOD. TRANSITORY STATES IN A NEWBORN PERIOD

Relevance of the topic. Neonatal period is the most important and critical period of life. In the adaptation of the child to the conditions of extrauterine life involves all the major functional systems. A transient reorganization of their activities is the essence of the neonatal period. Knowledge of these features allows the doctor to correctly interpret the processes occurring in the neonatal period.

Study objective. To study the features of neonatal period: signs of maturity and prematurity, transient states bordering on the disease. To learn how to carry out a primary toilet and patronage of a newborn.

Questions for self– checking

1. What is the term delivery?
2. Gestational age of a full-term baby.
3. Gestational age of a premature baby
4. Gestational age of a post-term baby
5. Morphologic criteria of maturity newborn.
6. Criteria for functional maturity newborn.
7. What are the transient states?
8. What are normal vital signs of a newborn?
9. What is the Apgar score?

the neonatal period occupies the first 28 days of life of the child, which is divided into:

- Early period (it lasts for 7 days).
- Late period (from the 8th day till the 28th day inclusive).

The child during this period of life is called a newborn.

At this age of life takes place adaptation of the body of the newborn to the new extrauterine conditions.

The World Health Organization defines normal term for delivery ranging from 37 weeks and 42 weeks. At birth, a baby is classified as one of the following: Premature [preterm] (less than 37 weeks gestation), Full term (37 to 42 weeks gestation), Post term (born after 42 weeks gestation). A Newborn child is a child aged from birth to 28 days.

NEWBORN BABY

The World Health Organization defines normal term for delivery as between 37 weeks and 42 weeks.

Pregnancy is considered "at term" between 37 and 42 weeks.

At birth, a baby is classified as one of the following:

- Premature [preterm] (less than 37 weeks gestation)
- Full term (37 to 42 weeks gestation)
- Post term (born after 42 weeks gestation)

Newborn child is a child between the ages of birth to 28 days. Neonatal period is divided into two periods: the early neonatal period (birth to 7 days) and late neonatal period (from 8 to 28 days).

Assessments for newborn babies:

Each newborn baby is carefully checked at birth for signs of problems or complications. A complete physical assessment will be performed that includes everybody system. Throughout the hospital stay, physicians, nurses, and other healthcare providers continually assess a baby for changes in health and for signs of problems or illness. Assessment includes:

1. Apgar scoring:

Pediatrician Joseph Butterfield has entered into use mnemonic rule for English-speaking professionals in 1963

- *Appearance*;
- *Pulse* (HeartRate);
- *Grimace* (ResponsetoStimulation) ;
- *Activity* (MuscleTone) ;
- *Respiration* .

APGAR is a quick test performed on a baby at 1 and 5 minutes after birth. The 1-minute score determines how well the baby tolerated the birthing process. The 5-minute score tells the doctor how well the baby is doing outside the mother's womb. The Apgar score is one of the first checks of your new baby's health. The Apgar score is assigned in the first few minutes after birth to help identify babies that have difficulty breathing or have a problem that needs further care. The baby

is checked at one minute and five minutes after birth for heart and respiratory rates, muscle tone, reflexes, and color.

Each area can have a score of zero, one, or two, with ten points as the maximum. A total score of ten means a baby is in the best possible condition. Nearly all babies score between eight and ten, with one or two points taken off for blue hands and feet because of immature circulation. If a baby has a difficult time during delivery, this can lower the oxygen levels in the blood, which can lower the Apgar score. Apgar scores of three or less often mean a baby needs immediate attention and care. However, only 1.4 percent of babies have Apgar scores less than seven at five minutes after birth.

Sign	Score = 0	Score = 1	Score = 2
Heart Rate	Absent	Below 100 perminute	Above 100 perminute
Respiratory Effort	Absent	Weak, irregular, orgasping	Good, crying
Muscle Tone	Flaccid	Some flexion of arms and legs	Well flexed, or active movements of extremities
Reflex/Irritability	Noresponse	Grimaceorweakcry	Goodcry
Color	Blue all over, or pale	Body pink, hands and feet blue	Pinkallover

2. Birthweight and measurements:

A baby's birthweight is an important indicator of health. The average weight for term babies (born between 37 and 41 weeks gestation) is about 7 lbs. (3.2 kg). In general, small babies and very large babies are at greater risk for problems. Babies are weighed daily in the nursery to assess growth, fluid, and nutrition needs.

- **Measurements:**

Other measurements are also taken of each baby. These include the following:

- head circumference (the distance around the baby's head) - is normally about one-half the baby's body length plus 10 cm
- abdominal circumference - the distance around the abdomen
- length - the measurement from crown of head to the heel

3. Physical examination:

A complete physical examination is an important part of newborn care. Each body system is carefully examined for signs of health and normal function. The physician also looks for any signs of illness or birth defects. Physical examination of a newborn often includes the assessment of the following:

- vitalsigns:
 - temperature - able to maintain stable body temperature 37° C (98.6° F) in normal room environment
 - pulse - normally 120 to 160 beats per minute
 - breathing rate - normally 30 to 60 breaths per minute
- general appearance - physical activity, tone, posture, and level of consciousness
- skin - color, texture, nails, presence of rashes
- headandneck:
 - appearance, shape, presence of molding (shaping of the head from passage through the birth canal)
 - fontanels (the open "soft spots" between the bones of the baby's skull) and clavicles
- face - eyes, ears, nose, cheeks
- mouth - palate, tongue, throat
- lungs and heart – breath and heart sounds
- abdomen - presence of masses or hernias

- genitals and anus - for open passage of urine and stool
- arms and legs - movement and development

4. Gestational assessment:

Assessing a baby's physical maturity is an important part of care. Maturity assessment is helpful in meeting a baby's needs if the dates of a pregnancy are uncertain. For example, a very small baby may actually be more mature than it appears by size, and may need different care than a premature baby.

An examination called The Dubowitz/Ballard Examination for Gestational Age is often used. A baby's gestational age often can be closely estimated using this examination. *The new scale Ballard uses six morphological and 6 neuromuscular signs, by which, counting the number of points can be estimated gestational age.*

The Dubowitz/Ballard Examination evaluates

- a baby's appearance,
- skin texture,
- motor function,
- reflexes.

Information often used to help estimate babies' **physical** and **neuromuscular** maturity is shown below.

The physical maturity part of the examination is done in the first two hours of birth. The neuromuscular maturity examination is completed within 24 hours after delivery.

- **Physical maturity:**

The physical assessment part of the Dubowitz/Ballard Examination looks at physical characteristics that look different at different stages of a baby's gestational maturity. Babies who are physically mature usually have higher scores than premature babies.

Points are given for each area of assessment, with a low of -1 or -2 for extreme immaturity to as much as 4 or 5 for postmaturity.

Areas of assessment include the following signs:

1. skin textures (ie, sticky, smooth, peeling).

2. lanugo (the soft downy hair on a baby's body) - is absent in immature babies, then appears with maturity, and then disappears again with postmaturity.
 3. plantar creases - these creases on the soles of the feet range from absent to covering the entire foot, depending on the maturity.
 4. breast - the thickness and size of breast tissue and areola (the darkened ring around each nipple) are assessed.
 5. eyes and ears - eyes fused or open and amount of cartilage and stiffness of the ear tissue.
 6. genitals, male - presence of testes and appearance of scrotum, from smooth to wrinkled, genitals, female - appearance and size of the clitoris and the labia.
- **Neuromuscular maturity:**

Six evaluations of the baby's neuromuscular system are performed. These include:

 1. posture - how does the baby hold his/her arms and legs.
 2. square window - how far the baby's hands can be flexed toward the wrist.
 3. arm recoil - how far the baby's arms "spring back" to a flexed position.
 4. popliteal angle - how far the baby's knees extend.
 5. scarf sign - how far the elbows can be moved across the baby's chest.
 6. heel to ear - how close the baby's feet can be moved to the ears.

A score is assigned to each assessment area. Typically, the more neurologically mature the baby, the higher the score.

When the physical assessment score and the neuromuscular score are added together, the gestational age can be estimated. Scores range from very low for immature babies (less than 26 to 28 weeks) to very high scores for mature and postmature babies.

CHARACTERISTICS OF A PREMATURE BABY

A **premature infant** have a lower birth weight than a full-term infant. The following factors may contribute to a premature birth:

- **Maternal factors:**
 - preeclampsia (high blood pressure of pregnancy, also known as toxemia or gestational hypertension)
 - chronic medical illness (such as heart or kidney disease)
 - infection (such as group B streptococcus, urinary tract infections, vaginal infections, infections of the fetal/placental tissues)
 - drug use (such as cocaine)
 - abnormal structure of the uterus
 - cervical incompetence (inability of the cervix to stay closed during pregnancy)
 - previous preterm birth
- **Factors involving the pregnancy:**
 - abnormal or decreased function of the placenta
 - placental abruption (early detachment from the uterus)
 - polyhydramnios (too much amniotic fluid)
- **Factors involving the fetus:**
 - multiple gestation (twins, triplets or more)

Common signs of prematurity include:

- The premature infant usually appears small and scrawny, with a large head in relation to body size, and weighs less than 2500 g.
- The skin is thin, smooth, shiny, and translucent, with the underlying vessels clearly visible. The arms and legs are extended, not flexed, as in the full-term infant.
- Soft, flexible ear cartilage

- There is little subcutaneous fat, sparse hair, few creases on the soles and palms, and poorly developed ear cartilage.
- Bodyhair (lanugo)
- Lower muscle tone and less activity than full-term infants
- Abnormal breathing patterns (shallow, irregular pauses in breathing called apnea)
- In boys the scrotum has few rugae, and the testes may be undescended. In girls the labia gape and the clitoris is prominent.
- Problems feeding due to trouble sucking or coordinating swallowing and breathing
- Among the common problems of the premature infant are variations in thermoregulation, chilling, apnea, respiratory distress, sepsis, poor sucking and swallowing reflexes, small stomach capacity, lowered tolerance of the alimentary tract that may lead to necrotizing enterocolitis, immature renal function, hepatic dysfunction often associated with hyperbilirubinemia, incomplete enzyme systems, and susceptibility to various metabolic upsets, such as hypoglycemia, hyperglycemia, and hypocalcemia.

Complications

Most complications relate to dysfunction of immature organ systems. In some cases, complications resolve completely; in others, there is residual organ dysfunction.

Lungs: Surfactant production is often inadequate to prevent alveolar collapse and atelectasis, which result in respiratory distress syndrome. Surfactant replacement therapy is used to both prevent and treat respiratory distress syndrome. In spite of this therapy, many premature infants develop a chronic form of lung disease known as bronchopulmonary dysplasia

CNS: Infants born before 34 wk gestation have inadequate coordination of sucking and swallowing reflexes and need to be fed intravenously or by gavage. Immaturity of the respiratory center in the brain stem results in apneic spells

Infection: Sepsis or meningitis is about 4 times more likely in the premature infant.

Cardiac: The ductus arteriosus is more likely to fail to close after birth in premature infants. The incidence of patent ductus arteriosus increases with increasing prematurity;

Temperature regulation: Premature infants have an exceptionally large body surface area to volume ratio. Therefore, when exposed to temperatures below the neutral thermal environment they rapidly lose heat and have difficulty maintaining body temperature.

GI tract: The small stomach and immature sucking and swallowing reflexes hinder oral or NGT feedings and create a risk of aspiration. Necrotizing enterocolitis usually manifests with bloody stool, feeding intolerance, and a distended, tender abdomen. Necrotizing enterocolitis is the most common surgical emergency in the premature infant.

Kidneys: Renal function is limited, so the concentrating and diluting limits of urine are decreased. Late metabolic acidosis and growth failure may result from the immature kidneys' inability to excrete fixed acids, which accumulate with high-protein formula feedings and as a result of bone growth

Metabolic problems: Hypoglycemia and hyperglycemia are discussed elsewhere.

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GUIDELINES
FOR STUDENTS

Academic discipline	Pediatrics
Study subject	Psychomotor development of the children of different age groups.
Course	3
Faculty	Medical 1

Kyiv-2016

Children's Neuropsychic Development Evaluation

Relevance of the topic.

The study of the formation of the nervous system in children and reflex activity of a healthy child are very important in the work of the pediatrician. These skills facilitate to assess the psychological development of children of various ages, identify rapidly any pathologies and eliminate them.

Study objective. To know the peculiarity of the children's nervous system in at different ages and indices of children's psychological development.

Questions for self- checking

EVALUATION neuropsychological development

The criteria for evaluation of neuropsychological development are:

- I . Motor skills; (motor function / movement)
- II .Static;
- III.Reflex activity (1 signal system);
- IV.Speech (2 signal system);
- V.The higher nervous activity.

I . Motor skills (movement ') - it is a purposeful, manipulative activities of the child.

1. Healthy **newborn** in the quiescent state is characterized by

- physiological muscle hypertonicity and against the background of this
- flexion posture. The arms are bent at all joints, and are pressed to the chest. Fingers are bent into a fist, thumbs brought to his hand. The legs also bent at all joints and slightly at the hips, to feet prevails REAR flexion. Even during sleep the muscles are not relaxed.
- Movement of the newborn are limited, chaotic, irregular (disorderly), trembling (trembling). Tremor and physiological muscle hypertonus gradually disappear after the first month of life.

2. At **2-3 weeks** there are the following skills:

- coordinated movements of muscle-eye, when the child fixes his gaze on a bright object;
- rotation of the head followed by a toy indicates the development of the cervical muscles

3. At **4 months** of life

- manual work hand is developed: the child closer his upper extremities to his eyes and has a good look at them.
- Movements are getting purposeful: the kid takes a toy by hands (in the second half of the year he could take a bottle of milk and drink it, etc.);

4. At the age of **4-5 months** the coordination of movement of the back muscles is developed, which is manifested by overturning (inversion) from back to stomach

5. **5-6 months** - baby can turn over from stomach to back;

6. At the end of the **first year** of life a child begins to walk, that is the result of coordinated purposeful movement of all muscles in the desired direction.

II. Static is a fixation and holding of specific parts of the body in the desired position. Signs of the static are following:

- **Holding** of the head - appears on the second or third month of life, a 3-month child should hold his head upright.
- The ability **to sit** - develops in 6-7 months. In addition, at the 6th month the baby begins **to crawl** (born creep, crawl), on the 7th - creeps well.
- The ability **to stand** - in 9-10 months.
- The ability **to walk** - to the end of the first year of life.

III. Reflex activity - it is an adequate response of the child to irritating environmental factors and their own needs. The main reflexes are following:

- Dominant food.
- By the end of the first month of the child **closely examines** his mother's face.
- In the second month a **smile** is formed
- In the third month - a joyous movement of the extremities at the sight of his mother is appeared.

- joyful exultation on his face (exultant air), smile, movement of hands, feet occurs at the approach of his mother, father
- auditory and visual concentration

1) to assess the hearing doctor claps hands at a distance of 30-40 cm from the side of the ear of the child lying on the changing table - a healthy baby should blink:

2) to determine the vision the doctor moves the bright toy at a height of 30 cm above the eyes baby lying on one side to the other - the child's eyes to follow the movement of the subject.

IV. Speech - there is a child in the 4-6 weeks when he starts halloo.

Pronunciation of the first sounds is called hum (buzz).

At 6 months, the child pronounces certain syllables (ba-ba-ba, ma-ma-ma, etc.), without understanding their meaning is called babbling baby-talk, (babble, prattle).

By the end of the first year of life in the lexicon of the baby is 8 - 12 words, the meaning of which he understood (let on, Dad, Mom, etc.). They include sound imitators (am-am - eat, *auto-auto* - dog, tick-tock - the clock, etc.).

At 2 years the vocabulary comes up to 300, there are brief suggestions.

V. Higher nervous activity.

This criterion is developed on the basis of formation of the nervous system, the formation of all the previous criteria, education and child development. It is a sign of maturity and mental ability and human intelligence. The final conclusion on the state of the higher nervous activity can be done in 5-6 years.

MAIN INDICATORS neuro-psychological development of children in different age periods

A **newborn baby** has a chaotic uncoordinated movements well expressed sucking, swallowing and protective reflexes. Among other unconditioned reflexes are the following transient reflexes:

- sucking - if you put a pacifier in baby's mouth, then baby starts to suck (there is a physiological reflex to 1 year);

- search - after stroking the skin in the corner of the mouth - turns his head (stored up to 1 year);
- hand-mouth (Babkin reflex) - when pressed on the palm near the thumb child opens his mouth (up to 3 months);
- grasping reflex (Robinson) - if you put your finger in the palm of a child, it tightly holds it (up to 2-4 months)
- reflex crawling (Bauer) - in position on the abdomen put under the foot palm - the child actively crawling (stored up to 4 months);
- reflex support - if you take a child by the arm from the side of the back, keeping the head with your thumbs, and put on the table - the child is on the table all the foot (up to 2 months).
- Moro reflex - to take the child on your hands and lower the down to 20 cm, in response to the first child throws up his hands to the side and extends the fingers and second child returns hands to the starting position

In the neonatal period there is a physiological muscular hypertension with a predominance of flexor tone, *bent limbs*, hands compressed into fists. The baby feels the touch, has a sense of smell, taste, bright light and reacts to loud noises. A newborn sleeps 22-23 hours a day.

In infancy following **statokinetic and mental functions** are formed:

1 month: the child observes a moving object, listens to the voice, smiling, lying on his stomach, raises and tries to hold the head, pronounces fuzzy sounds (utters a mushy sound).

2 months: - long observes of moving toys, turns his head to the sound and begins to smile when speaking, holds the head while lying on his stomach, pronounces some sounds (utters some sounds). Baby sleeps 20 hours a day.

3 months: - carefully peers into moving bright objects, turns his head toward the sound, keep /hold/ his head in an upright position, *often coo*. Baby sleeps 18-19 hours a day.

4 months: - knows the mother, responds to music, try to take the toy, rests his feet in an upright position, utters various sounds.

5 months: - distinguishes relatives and intonation in his voice, rejoices children, takes their toys and keeps them; independently turn over from the back on his stomach, stands with support and sits; long hulyt; eats dense food with a spoon.

6 months: - responds to his name, takes toys, shift them to one's other arm, turns from the abdomen to the back, sits well, try to crawl, begins to babble, drinking from a cup. Baby sleeps 16-18 hours a day.

7 months: - plays with toys for a long time, well crawling, try to sit down, recognize things, long babble says syllables.

8 months: - plays with toys long time, repeats movements of adults, independently sits, lies down, knows own name, repeats syllables by adults.

9 months: - moves to the music, makes "good bye", repeats syllables from adult, sits on the potty. Baby sleeps 15-16 hours a day.

10 months: - performs various actions with toys at the request of an adult, walks, holding hands, gives known subject, repeats words.

11 months: - performs actions with toys on request, says first words.

12 months: - distinguishes objects, looking for toys by, yourself walks, says 8 - 10 words, independently drinks from a cup (takes and puts it).

Child 1-1,5 years very active, curious, active gets acquainted with the world. Pronounces up to 20 words, he knows titles of many objects, body parts.

Child to 1.5-2 years says short sentences well distinguish smells, noises and sounds. Willingly listens to music, self-eating spoon. Performs simple tasks, understand the ban. He walks alone, kneels to pick up a toy. Sleep is 14-16 hours a day.

Child 2-3 years of contact, emotional, asks questions. Good runs, plays with small objects.

In children 3-5 years speech becomes more diverse, there are personal opinions; character, manifestations of independence, stubbornness are formed. The child quickly learns words, foreign languages, painting and music.

A child 6-8 years motor skills are well developed, transmits thoughts and impressions. They easy masters skills of reading and writing.

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Academic discipline	Pediatrics
Study subject	Physical development of the children of different age groups. Techniques of anthropometry.
Course	3
Faculty	Medical 1

Kyiv-2016

Actuality of the topic:

1. Despite the introduction to the practice of laboratory and imaging studies, the clinical examination of patients is the most important in the diagnosis. Competently and completely collected complaints, anamnesis of disease and life are of great importance in the formulation of the preliminary diagnosis and determining the amount of paraclinical examination of the patient.
2. Physical development is one of the integrative health indicators of biological maturity of all body systems. The study of the formation of the nervous system in children and reflex activity of a healthy child are very important in the work of the pediatrician. These skills facilitate to assess the psychological development of children of various ages, identify rapidly any pathologies and eliminate them.

Study objective. To master the technique of anthropometric measurements of children of different ages, to be able to assess the physical development of the child, know the peculiarity of the children's nervous system in at different ages and indices of children's psychological development.

Questions for self– checking

1. The main indicators of physical development.
2. The main indicators of psychological development.
3. Methods of basic anthropometric measurements and the necessary equipment
4. Regularity of increase in the mass and body length, chest circumference and head at various age periods
5. Factors affecting the children's physical development

PHYSICAL DEVELOPMENT OF CHILDREN.

Relevance of the topic. Physical development is one of the integrative health indicators of biological maturity of all body systems.

Knowledge of the normal growth and development of children is essential for preventing and detecting disease by recognizing overt deviations from normal patterns.

To identify and treatment underlying disorders, all who care for children must be familiar with normal patterns of growth and development so that they can recognize abnormal variations.

One goal of pediatrics is to help each child achieve his or her individual potential for growth and development and thus become a mature adult. Periodically monitoring each child is obligatory for the normal progression of growth.

The study of the formation of the nervous system in children and reflex activity of a healthy child are very important in the work of the pediatrician. These skills facilitate to assess the psychological development of children of various ages, identify rapidly any pathologies and eliminate them.

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4. Regularity of increase in the mass and body length, chest circumference and head at various age periods
5. Factors affecting the children's physical development
6. Anatomical and physiological characteristics of the central nervous system formation in children.ϕ
7. Formation of physical activity.
8. The disruption and central nervous system malformations.

As the result of topic covering the student must be able to:

1. Measure body's mass and length enlargement, of thorax and head circumference.
2. Make the approximate calculation of the main anthropometrical indexes for a child of any age.
3. Estimate the physical development of a child using centil and signal standards schemes.

Physical development is a dynamic process of growth and biological maturation of the child in a different period of childhood.

In assessing the physical development of the child should know his height, weight, proportion of body parts.

Degree of physical development depends on either genetics or from a complex set of social conditions. There are endogenous and exogenous factors that affect the body mass, height and other factors after birth. Endogenous causes connected with

the influence of the endocrine glands in the organism of the child. In the early period of the thymus gland exerts this effect, the thyroid gland - from the end of the first year of life, and the pituitary gland from 3-4 years. The level of hormones involved in the growth process is determined by genotype. Hormones that contribute to growth are pituitary growth hormone (GH), thyroid hormones and insulin. GH stimulates chondrogenesis and thyroid hormones affect the bone formation. Exogenous factors - these are the conditions in which a child gets after birth. First, it is food (plastic material and energy). Quantitatively and qualitatively inadequate nutrition inhibits the growth of body weight, and then growth. Secondly, UV rays are important, and therefore the increase in body weight and growth is seasonally adjusted. Third, climatic and geographical conditions are important. Physical activity, which increases bone growth and metabolism affect the growth of the child. Physical development is an indication of the functional maturity of the body.

EVALUATION CRITERIA OF PHYSICAL DEVELOPMENT

The main criteria for the physical development of the child are:

- Body weight;
- Body length (growth);
- Head circumference;
- Chest circumference;
- The proportionality of these parameters.

Method for determination and calculation of the physical development of a healthy child

The mass of the body.

Body weight of full-term newborns ranges from 2600g to 4000g, and the average is 3-3.5 kg. Normally, during 3-4 days after birth, the physiological weight loss is observed in most of the children. The maximum weight loss is observed on the third day and amounts to 6-8% of total body weight at birth. Loss of more than 10% of birth weight is considered as abnormal and indicates the disease or deficiencies in the care of children.

The physiological loss of the mass of the body is caused by several factors - the extrarenal loss of the fluid due to the perspiration through the skin and the lungs (perspiration insensibilis), the discharge of the meconium and the fetal urine, the discharge of the amniotic fluid in the delivery, the drying of the remnants of the umbilical cord, and "fasting" for the first half-day after the birth.

The subsequent recovery of body weight can occur in several ways. Two major types of such recovery may be identified:

- "Ideal" type (after Budin): the recovery of the mass at birth is attained by 7-8 day. Such type is revealed in 20-25% of newborn babies.
- The delayed type (after Piss): the recovery of the mass at birth is attained within 11-15 days. Such type is revealed in 75-80% of newborn babies.

After the restoration of body weight is a further increase in weight. Average increase of the first month after birth is 600 grams.

Dynamics of body weight is characterized by greater increase in the first 6 months of life and by lesser one at the end of the first year. Body weight doubles to 4.5 months' and triples to the year, despite on the fact that this index may vary, depending on the power of an illness, etc. Energy of increase in body weight with each month of life is waning.

To calculate the weight of the child the doctor uses a certain formula.

Weight increases by 800 g per month in the first half, second half - by 40 g.

$$M = m + 800 \times n$$

$$M = m + 800 \times 6 + 400 \times n, n - \text{months of age}$$

Example: body weight at birth was 3500 g, and now his age is 9 months, thus at this age, body weight should be equal to $3500 + 800 + 400 \times 6 \times 3 = 9500$ g.

After a period of breastfeeding before the age of 10 years, body mass is calculated by the formula:

$$M = 10 \text{ кг (average body weight of the child 1 year)} + 2 \times n,$$

n — years of age .

After 10 years, body mass increases by 4 kg per year.

An examples:

- A child is 2 years; body weight at 1 year was 12 kg and the body weight in 2 years should be equal to $= 12 + 2 \times 2 = 16$ kg;

- A child is 13 years old, body weight should be equal to $= 10.5 + 10 + 2 \times 4 \times 3 = 42.5$ kg;

- The baby-weight at birth was 3800, he is 4 years old, the body weight is equal to $3.8 + 0.8 + 0.4 \times 6 \times 6 + 2 \times 4 = 19$ kg.

Regulation of body weight measurements are:

Children up to 6 months are placed on the special children's electronic scales in the supine position. The child over 6-7 months may be on the same scale in a sitting position.

Body weight of the child over the age of the year is measured in the balance in a standing position.

To determine the exact weight of the child, weighing is carried out in the morning before the first feeding after urination and defecation.

The length of the body

The most stable indicator of physical development is the growth of the child. It determines the absolute length of the body and accordingly the increase of body size, development, maturation of organs and systems, the formation of functions at a certain period of time. The growth reflects the features of plastic processes in the human body. Retarded growth could cause different chronic diseases. Throughout the life of a child, a process of growth occurs irregularly.

The length of the body at birth of babies born in due term is 50-52 cm on the average. The length of the body in boys exceeds that in girls by two centimeters.

For calculation of parameters of growth, the following regularities are used:

- during the first quarter (quarter is 3 months) growth increases by 3 centimeters per month,
- during the second quarter - by 2.5 cm per month,
- during the third quarter - by 2 cm per month;
- during the fourth quarter - by 1-1.5 cm per month.

During 12 months the length of the body increases by 1.5 times. The average growth of the baby 1 year old is 75 cm. The average growth of the baby 4 years old is 100 cm.

The average length of the body up to 4 years increases by 8 cm per year (in 4 years is 100 cm). To determine the child's growth under 4 years, the following formula is used:

$$L (\text{under 4 years}) = 100 - 8 (4-n)$$

After 4 years length of the body increases by 6 cm per year.

$$L \text{ (over 4 years)} = 100 + 6 (n-4)$$

Examples: Boy is 5 months, body length at birth is 56 cm, body length in 5 months is $56 + 3 \times 3 + 2,5 \times 2 = 70$ cm;

Body length after infancy increases unevenly in different years of life, and also depends on the sex. More rapid increase in body length, so-called first push growth (elongation) is observed in 4-5.5 years for boys and 6.7 years for girls. Then the growth rate slows down. In 11-14 years in girls and 12-17 in boys with a second push growth and then - a significant slowdown. Body length reaches its maximum in 18-20 years.

Rules of measuring the length of the body are following.

A child of the first year is placed on a horizontal stadiometer covered diaper. The baby's head is located near the immovable wall of stadiometer, so that the upper edge of the ear canal and the edge of the lower eyelid baby are on the same vertical line. The lower limbs are straightened and are pressed against the wooden surface.

The movable plate is applied to the feet. Body length is the distance from the immovable wall to movable bar. It is indicated by the numbers along the stadiometer.

The length of the older children is measured in a standing position on a standard wooden stadiometer. The child is pressed against the vertical

bar back of his head, spine between the shoulder blades, the sacrum and heels.

Head circumference and chest size measurements are often taken on newborns and infants by a pediatrician to measure growth levels and development.

The **head circumference (HC)** is different in different babies and might depend on many factors. Certain of those factors are completely harmless, while others are

pathological. For example, if one of the parents has a head that is pretty small or pretty big compared to the rest of the body, it is quite normal to expect that the baby might develop the same head-to-body proportion. However, if the head is too big it might be a sign of hydrocephalus (a condition in which the liquor in the head cannot drain further and is accumulated in the cranial cavity (around the brain beneath the bones of the skull)). This liquor increases the pressure inside the head and affects the development of the brain.

The head of the newborn infant makes up almost one third of total size compared with the adult proportion of approximately 1:7[39].

Normally at birth, head circumference is larger than chest circumference. The head circumference of the full term newborn is about 2-3cm greater than the chest circumference which average 30.5-33cm [40]. By the age of four months, the head circumference equals the chest circumference, and later the chest circumference is larger than head circumference except in the presence of malnutrition[41]

Head circumference is measured by centimeter tape. It is applied on the site behind the maximum protrusion

of the occipital protuberance, front on supraorbital arches.

Head circumference in term infants varies quite widely - from 33.5 to 37.5 cm, the average is 35 cm.

Indicators of growth of head circumference are following:

I half-year – increase this index occurs by 2 cm per month;

II half - by 0.5 cm per month;

up to 5 years - 1 cm per year, up to 15 years - by 0.6 cm per year.

HC (under 5 years) = 50 - 1 (5-n)

HC (over 5 years) = 50 + 0,6 (n-6)

Another important parameter used for the assessment of the harmonicity of physical development is the **circumference of the thorax**. This value closely correlates with the functional parameters of respiratory and cardiovascular systems. The following formulas are used for estimating the indicators of increasing chest circumference:

a) The chest circumference at the age of 6 months is taken as 45 cm. At the first 6 months increase of this parameter occurs by 2 cm per month, in the second half of the year - by 0.5 cm per month.

CC (I half) = 45 - 2 (6-n)

CC (II half) = 45 + 0,5 (n - 6)

b) For the children at the age from one to ten years, the following formula may be used:

CC= 63 - 1.5 (10 - n)

For the children at the age over ten years:

CC= 63 + 3 (n - 10),

where n – age in years, 1.5 or 3 cm – mean annual increment value, 63 cm – mean circumference of the thorax at the age of ten year

.Пример: ребенку 13 лет, окружность грудной клетки при рождении 33 см, в 13-летнем возрасте параметр приблизительно равен $33 + 2 \times 6 + 0,5 \times 6 + 1,5 \times 9 + 3 \times 3 = 70-71$ см.

Chest circumference in infancy is measured in the supine position, with the second year of life - in the standing position. Measuring tape is placed back at an angle of blades, the front - on nipples.

Thus, in the first half of the circumference of the chest monthly increases faster (2 cm) than the circumference of the head (1,5 cm). And in the four months of age is celebrated so-called "decussation" when their sizes are the same. Later in the second half the head is identical to the monthly increase in the chest increase (0.5 cm), and then to 15 chest "grow" much faster than the head.

Tests.

1. The main indicators of physical development
 - A. Body weight, Body length (growth), Head circumference
 - B. body weight, respiratory rate, vital capacity,
 - C. body weight, head circumference, heart rate, body length
2. Monthly weight gain in the first half
 - A. by 400 g per month
 - B. by 600 g per month
 - C. by 800 g per month
 - D. by 200 g per month
3. The monthly increase in body length in the 1st quarter
 - A. by 1 centimeter in quarter
 - B. by 2 centimeters in quarter
 - C. by 3 centimeters in quarter
 - D. by 4 centimeters in quarter
4. The annual increase in body length after 4 years
 - A. by 6 centimeter
 - B. by 8 centimeters
 - C. by 3 centimeters
 - D. by 4 centimeters

Task. Girl 8 months, was born with a body length 54 cm, head circumference 35 cm Calculate the appropriate normative anthropometric indices.

Answers: 1- A; 2 - B; 3 - C; 4 - A; Task: Body length = $54\text{cm} + 3 \times 3 + 2,5 \times 3 + 2 \times 2 = 74,5 \text{ cm}$.

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**MINISTRY OF PUBLIC HEALTH OF UKRAINE
O.BOHO MOLETS NATIONAL MEDICAL UNIVERSITY**

PEDIATRIC DEPARTMENT N5

"Approved"
on the methodical conference
Department of Pediatrics № 5
protocol №2 from 07.09.2016

**GUIDELINES
FOR STUDENTS**

Academic discipline	Pediatrics
Study subject	Anatomical and physiological peculiarities of skin and appendageal structures of children. Physical examination of skin and subcutaneous fat of a child. Semiotics of skin and adipose tissue diseases of children. Anatomical and physiological peculiarities of musculoskeletal system of children. Semiotics of musculoskeletal system diseases in pediatric practice.
Course	3
Faculty	Medical 1

Anatomical and physiological characteristics of the skin and subcutaneous fat in children. Research Methodology. Semiotics lesions

Actuality of theme. Skin and subcutaneous adipose tissue actively participate in all metabolic and immunological processes and are among the tissues that early childhood developing rapidly. Therefore skin and subcutaneous fat may indicate a disease of the whole body.

The purpose of classes. To study the anatomical and physiological features of the skin and subcutaneous fat in children of all ages know and be able to recognize the symptoms of damage.

Because **self-training** the student should know:

1. Anatomical and physiological characteristics of the skin and subcutaneous adipose tissue in different periods of childhood.
2. Functions of the skin and subcutaneous fat in the age aspect.
3. Physiological and borderline (transient) conditions of the skin and subcutaneous fat in the neonatal period.
4. Methods skin and subcutaneous fat.
5. semiotics lesions of the skin and subcutaneous fat.

Because the study theme the student should be able to:

1. To collect anamnesis, find out complaints specific to diseases of the skin and subcutaneous fat.
2. Assess color, moisture, temperature, skinfold thickness, elasticity, dermographism, state of capillaries, acne aza presence to determine its characteristics.
8. Assess the state of subcutaneous adipose tissue (turgor, edema, pastoznost, compaction, degree of development).

The skin is the largest organ of the body, with a total area of about 20 square feet.

The skin is one of the most important parts of our body, and it takes constant care and attention to keep it looking its best.

The human skin is primarily composed of three major layers, namely the epidermis or the outermost layer, the dermis and the subcutaneous tissue. Under each layer there are several other layers which all have their specific functions to keep our skin healthy.

Basic physiological functions of the skin

1. Skin is a **protective barrier**, but this function is shown poorly in the children. For a doctor skin is a **sign of internal organs' condition disorders** (hyperthermia, disorder of water metabolism, etc.). The protective function is an immature function, it occurs because of thin epidermis and dermis, immature basal membrane, a little amount of fibrous structures and a good developing of blood vessels network.
2. The bactericidal function is an immature function, it is due to pH of the newborn skin (6.1-6.7) in an adult pH is acidic (4.2-5.6)). This pH medium is favourable for developing microbes.
3. **Thermoregulatory function** is developed poorly in the newborn child but it is necessary to remember at care of a child (bathing, swaddling); this function begins its full activity only in few months after birth. It is immature function as the result of high emission heat process and immature heat production. The high emission heat processes occur because of a thin skin, a later beginning of sweat glands functioning, a well developed superficial vessel network, the vessels are in physiological vasodilatation. Muscles of the hair bulbs are poor developed, so gooseflesh does not appear.
4. **The respiratory function** of skin is developed more (is well developed) in a child; most intensively it is 8 times stronger than in an adult person. It helps immature lungs to perform the respiratory function. Well developed respiratory functions are caused by puffy and thin skin, a well developed superficial vessel network, physiological vasodilatation of vessels.
5. The secretory function - vitamins, enzymes, biologically active substances are formed in the skin. The skin secretes keratin, squalen, calcium and phosphorus. In a newborn the secretion of keratin and squalen is decreased, the secretion of calcium and phosphorus is increased.
6. The deposition function is well developed. The skin is the depot of blood and water.

7. The reception (receptor) function is well developed. There are a lot of nerves in the skin, so the skin is a peripheral analyzer that grasps endo- and exogenous stimuli.
8. **The excretory function** of skin is underdeveloped in children of early age; 700-1300 ml of sweat is secreted in the adult. The excretion function is provided by sweat glands. The skin excretes some products of metabolism of fat and carbohydrate and different medicaments. The excretion function of the skin begins with the beginning of functioning sweat and sebaceous glands (3-4 months).
9. **The reabsorption function (absorptive)** is shown more intensively in children of breast-feeding age, this fact should be remembered when epicutaneous medications are prescribed to them. The resorption is well developed. It is caused by puffy and thin skin, well developed superficial vessel network, a great number of sebaceous glands and hair follicles. But resorption depends on the chemical structure of the substance: liposoluble substances are well absorbed, water-soluble substances are nonabsorptive.
10. The buffer function is poorly developed, because in newborn and young children pH of the skin is nearly neutral (pH 6.1-6.7) therefore the skin can't neutralize acids and alkaline.
11. **Thermoregulatory function** is developed poorly in the newborn child but it is necessary to remember at care of a child (bathing, swaddling); this function begins its full activity only in few months after birth.
12. The pigmentation function is immature.
13. The synthesis of vitamins. The skin synthesizes vitamin D and other biologically active substances.
14. The metabolic function is well developed, therefore newborns and young children have a high regeneration of the epidermis and the dermis.
15. The chromogenic function- melanin chromogenesis

Skin has three layers:

- The epidermis, the outermost layer of skin, provides a waterproof barrier and creates our skin tone.
- The dermis, beneath the epidermis, contains tough connective tissue, hair follicles, and sweat glands.
- The deeper subcutaneous tissue (hypodermis) is made of fat and connective tissue.

There are some peculiarities of the **dermis** in the newborn and young (little) children:

- In the newborn the papillary layer is poorly developed. In the premature infant it is absent.
- The dermis has an embryonic structure - it has a lot of cellular elements and a little amount of fibrous structures. Elastic fibres are absent. They first appear in 5-6 months of life.
- Labrocytes (mast cells) have a high biological activity.
- In the newborn the quantity of water is higher than in an adult (80 % and 6-8 % respectively) in the dermis.
- The basal membrane is poorly developed. It leads to easy separation of the epidermis from the dermis, it results in epidermolysis.
- Morphological maturity of the derma occurs by 6 years.

The clinical significance. A newborn and an infant more often show blistering (bullous) reactions caused by the poor adherence between the epidermis and the dermis and frequently affected by chronic atopic dermatitis (eczema).

Skin appendices

Sebaceous glands are placed on the whole surface of the newborn's skin, except palms and soles. Their function is manifested already in the 7th month of intra-uterine development. Children after a birth can often have yellow-pink points 1x1 mm of size reminding grains of millet on the tip and wings of nose and adjoining parts of cheeks. These are occluded excretory channels of sebaceous glands - **milia**. They gradually disappear in 2-3 months. Treatment is not demanded.

Sweat glands are underdeveloped at birth. Sometimes **miliaria** are met on the skin of a child they are occluded excretory channels of sweat glands which look like drops of water. Their formation comes to the end on a forehead and head firstly, further - on the skin of thorax and back. The most active sweating presents within first two months of life. This function formation implements during 7 years. An adequate sweating response on the environment temperature is marked only in children of early school age.

The hair which covers the child's skin at the time of birth drops out after a short time. Constant hair grows up instead of it. Eyelashes of the children grow quickly, and their length at 3-5-year's age remains the same for the whole life. The thickness of hair increases with the years.

The technique of the examining of the skin

Technique of research skin includes

- anamnesis,
- physical examination (inspection),
- palpation.

Anamnesis

- the time of occurrence of skin changes (when they come)
- where the first elements of the rash appeared, what they looked like, were single or multiple;
- How is rash spread, its localization, symmetry;
- Rash changes over time (change in color, shape, size of elements, the occurrence of peeling);
- Accompanied skin changes by the temperature reaction;
- Whether the child was in contact with infectious patients;

Inspection and palpation.

The skin is assessed for

- color,
- texture,
- temperature,
- moisture
- elasticity

Hair is also inspected for color, texture, quality, distribution, and elasticity.

With palpation thickness of elasticity, moisture content of the skin temperature is determined. The doctor **palpates** the skin for

- texture,
- moisture
- temperature.
- elasticity

Any marks or scars that are suggestive of healed injuries are noted, and inquiries are made about their origin. Normally the skin of young children is smooth, soft, and slightly dry to the touch, not oily or clammy. Any variations from these findings are noted, because they may indicate common problems of childhood such as cradle cap (scaliness on the scalp), eczema (scaliness and desquamation on the scalp, cheeks, knees, and elbows), diaper rash (redness and dryness in the genital area), or excessive dryness (xeroderma) all over the body from too frequent bathing, exposure to the weather, or vitamin-A deficiency. Excessively moist, clammy skin may indicate serious health problems, particularly heart disease.

Assessment of the temperature. A doctor evaluates the skin temperature by symmetrically feeling each part of the body and comparing the upper areas with

the lower ones. Any distinct difference in temperature is noted. Although not a common anomaly, one of the key signs for coarctation of the aorta is warm upper extremities and cool lower ones. A doctor also observes the skin temperature of the dressed child. Young children produce heat rapidly, and they quickly become overheated if dressed too warmly. Many parents do not realize this and fail to change the amount of clothing to accommodate climactic variations.

Assessment of the texture of the skin. A doctor palpates the skin in symmetric spots of the body and in the extremities particularly on the palms and soles and notes their moisture and temperature. Normally the skin of young children is smooth, soft and slightly dry to the touch, not oily or clammy.

Assessment of the skin elasticity. It is best determined by grasping the skin on the external surface of the palms or flexor surface of an elbow between a thumb and index finger, pulling it taut, and quickly releasing it. Elastic tissue immediately assumes its normal position without residual marks or creases. In children with poor skin elasticity and turgor the skin remains suspended or tented for a few seconds before slowly falling back.

For **determining of elasticity** a doctor grasps **only a skin layer** near the umbilicus or on the dorsal surface of a hand, with a big and index fingers

SUBCUTANEOUS LAYER

Anatomical and physiological features:

- The subcutaneous layer is **relatively thicker** in children of breastfeeding age, concerning their general body weight, than in the adult person; the rotundity of their body is explained by this factor.
- **The distribution of subcutaneous adipose tissue is uneven after the birth;** it is well developed on all sites of trunk at a newborn and, especially, on the second month of life, except stomach where the intensive growth is marked by the 6th months of age.
- The significant feature of fatty tissue is the presence of so-called **brown adipose tissue** (1-3% from a total body weight).
Mostly it is situated in back cervical, axillary areas, around thyroid gland, kidneys, in interscapular space, around the main vessels.

The basic function of the brown fatty tissue is heat production, not connected with muscular contraction - it is much as possible expressed as in the first life days; heat produced by child can protect him during two days when the child is cold. Heat production is being reduced with the years and the brown fatty tissue disappears in some months; the necessity of warming (putting a newborn into incubator- see Fig. 57) of deep preterm born children can be explained by the weakness of this function.

- **The tissue of embryonic genesis** which carries out the hemopoiesisfunction, remains in the subcutaneous layer during the breast-feeding period of life.
- **Adipose tissue is almost absent in chest and abdominal cavities, in retroperitoneal space in the children till 5-7 years**, that allows internal organs to be displaced easily.

The technique of the examining of the subcutaneous adipose tissue includes inspection and palpation

On **inspection**, the doctor determines the degree of development and proper distribution of subcutaneous fat layer

Then next parameters are estimated **by palpation**:

- **thickness of the subcutaneous layer and**
- **tissue turgor.**
- **edema definition**

Skin eruption elements:

Primary: appear on visually unchanged skin.

- Spot (makula): primary non-cavernous skin eruption element which changes skin colour only, disappears when pressed. They are divided into inflammatory and noninflammatory
 - ✓ Inflammatory spots are caused by dilation of blood vessels, they disappear when pressed with your finger on the skin and appear again at pressure termination.
 - ✓ Noninflammatory spots do not disappear when pressure.

According to its size Inflammatory spots are divided into

- roseola - diameter up to 5 mm, *finely point* 1-2 mm are in typhoid and typhus, paratyphoid A and B, syphilis;
- Finely spotty - 5-10 mm (scarlet fever);
- Big spotty - 10-20 mm (measles);

➤ erythema - more than 20 mm.

Among the spots of non-inflammation genesis **hemorrhagic** ones are the most frequent; they are divided into

- petechia,
- purpura (2–5 mm in size),
- linear (vibices),
- ecchymosis (“bruises” – >5 mm),
- big formless spots – suggillation,
- haematoma.

The spots can be dypigmented (vitiligo, albinism), hyper pigmented (freckles, chloasma, birthmarks). Telangiectasia (vessels units having a star form) are also treated as spots. They are the evidence of liver affection.

- Papule (papula): a vessel knot, non-cavernous element which changes skin consistence and relief. Appears as a result of different pathological processes taking place in epidermis and upper skin layers (infiltrate skin accumulation, skin tissues hypertrophy, protein products precipitations).

Depending on size the following types are distinguished:

- miliary,
- lenticular (up to 0.5 cm),
- numilar (1–2 cm).

They may be of inflammation and non-inflammation (warts) genesis. Papule is most frequent in case of scab, lichen pilaris, measles, German measles and purpura rheumatica.

- tubercle (tuberculum): a non-cavernous element located in the reticular layer of derma, up to 1 cm in diameter, prominent on the skin surface. May be of inflammation and non-inflammation nature. Appears in case of syphilis, wolfish herpes, leprosy and leishmaniasis.
- Nodule (nodulus): a non-cavernous element located in derma. May be of non-inflammation (atheroma, lipoma) and inflammation (strophulus, leprosy, furuncle, carbuncle, erythema nodosum) genesis.
- Vesicle (vesicula): a primary non-cavernous element having a bottom, cover and content. If it is less than 1 cm in diameter, it is vial; if more than 1 cm in diameter, it is bulb (bulla). The content may be serum, hemorrhagic and purulent. May be located either in epidermis or below epidermis. It is typical of eczema, chicken pox, shingles. The bulb is typical of burns.
- Pustule (pustula): a non-cavity element with purulent content located in epidermis, derma or subcutaneous. May be connected (osteofolliculitis,

folliculitis, acne and hydradenitis) and disconnected (impetigo) with skin appendages; deep and superficial.

- **Bulb (urtica):** a non-cavernous element (stands between cavernous and non-cavernous ones), forms as a result of temporary surface blood vessels widening and liquid blood components release. Examples: nettle rash, insects bites, nettle burns, allergic dermatosis).

Secondary: a stage of primary and secondary elements development.

Secondary pigmentation: skin colour change on the place of the previously existing element.

- **Peel (squama):** an element consisting of surface epidermis layers, skin fat, dust and bacteria.
- **Erosion (erosio):** a defect in the epithelium boundaries.
- **Ulcer (ulcus):** is a the deep defect of skin which reaches the cellar layer, is formed of the deep primary elements.
- **Excoriation (excoriatio):** a scratch, abrasion. Is a linear skin defect caused in a mechanic way.
- **Crack (rhagades):** a linear skin defect formed as a result of skin wholeness and elasticity.
- **Crust (crustae):** a dry exudation; appears on places of all the cavernous elements or on the places of secondary elements accompanied by the skin wholeness affection.
- **Cicatrice (cicatrix):** conjunctive tissue replaces skin.
- **Atrophy :** all the skin layers get thinner.
- **Lichenification (lichenificatio):** all skin layers get thicker, the skin has a clear, intensive pattern (neurodermatitis, eczema). The skin is whole, coarse, the picture is enforced, there is a lot of furrows, practically cannot be folded.

The ambiguity of skin eruption elements is called polymorphism. The real (true) polymorphism is represented by several different primary elements, while the false one is represented by one primary element on different stages of its development.

**MINISTRY OF PUBLIC HEALTH OF UKRAINE
O. BOHOMOLET'S NATIONAL MEDICAL UNIVERSITY**

PEDIATRIC DEPARTMENT N5

"Approved"
On the methodical conference
Department of Pediatrics № 5
protocol №2 from 07.09.2016

**GUIDELINES
FOR STUDENTS**

Academic discipline	Pediatrics
Study subject	Anatomical and physiological peculiarities of nervous system of children. Physical examination of nervous system of a child. Semiotics of neurologic diseases in pediatric practice. Cerebrospinal fluid studies: macro- and microscopic findings in hydrocephalus, meningitis.
Course	3
Faculty	Medical 1

Kyiv-2016

Relevance of the topic.

The study of the formation of the nervous system in children and reflex activity of a healthy child are very important in the work of the pediatrician. These skills facilitate to assess the psychological development of children of various ages, identify rapidly any pathologies and eliminate them.

Study objective. To know the peculiarity of the children's nervous system in at different ages and indices of children's psychological development.

Questions for self-checking**Anatomical and physiological features NERVOUS SYSTEM IN INFANTS****Brain:**

- pyramidal cells do not have their characteristic form, in which pigment is absent;
- immaturity dendrites in nerve cells;
- cortex centers are not formed;
- in newborns hemisphere are poorly developed, only the main furrows are formed,
- brain tissue is very rich in water;
- gray substance is poorly differentiated from white.

Spinal cord:

- more mature than the brain, only the number of nerve cells increases with age;
- relatively is longer than than in adults;
- has no physiological thickening;
- spinal cord completely fills spinal canal until the 5th month of intrauterine development.

Peripheral nerves:

- a small number of myelinated fibers

Analyzers:

- **visual analyzer** -- physiological photophobia observed up to 2-3 months of age, physiological nystagmus, physiological hyperopia, with a 6-month old child distinguishes colors;
- **auditory** - sound perception in newborns reduced because the tympanic cavity is filled with air; with a 2-month old child differentiates the sounds; 7-8 months of life there is coordination of auditory and visual analyzers;
- **olfactory** -the sensitivity threshold is reduced in newborns, they only accept strong odors; starting from the 4th month of the child differentiates the several odors;
- **gustatory analyzer** - receptor field of neonatal is wider, sensitivity threshold is higher than in adults; with 3 months of life the child differentiates the multiple taste sensations; thin mouthfeel are improved in the early school years.

sensitivity:

- tactile - determined from the 7th month of fetal life,
- better developed on the face, soles, hands;
- temperature - the child perceives the cold better;
- pain - is poorly developed, formed before the 6th day after birth,
- deep (vibration, musculo-articular sensitivity, feeling of pressure, weight) - is formed by up to 2 years of life.

The vegetative nervous system:

- both departments are functioning at birth;
- in the blood of newborns predominates norepinephrine;

MAIN INDICATORS neuro-psychological development of children in different age periods

- A newborn baby has a chaotic uncoordinated movements well expressed sucking, swallowing and protective reflexes. Among other unconditioned reflexes are the following transient reflexes:
- sucking - if you put a pacifier in baby's mouth, then baby starts to suck (there is a physiological reflex to 1 year);
- search - after stroking the skin in the corner of the mouth - turns his head (stored up to 1 year);
- hand-mouth (Babkin reflex) - when pressed on the palm near the thumb child opens his mouth (up to 3 months);
- grasping reflex (Robinson) - if you put your finger in the palm of a child, it tightly holds it (up to 2-4 months)
- reflex crawling (Bauer) - in position on the abdomen put under the foot palm - the child actively crawling (stored up to 4 months);
- reflex support - if you take a child by the arm from the side of the back, keeping the head with your thumbs, and put on the table - the child is on the table all the foot (up to 2 months).
- Moro reflex - to take the child on your hands and lower the down to 20 cm, in response to the first child throws up his hands to the side and extends the fingers and second child returns hands to the starting position
- In the neonatal period there is a physiological muscular hypertension with a predominance of flexor tone, bent limbs, hands compressed into fists. The baby feels the touch, has a sense of smell, taste, bright light and reacts to loud noises. A newborn sleeps 22-23 hours a day.

In infancy following statokinetic and mental functions are formed:

- 1 month: the child observes a moving object, listens to the voice, smiling, lying on his stomach, raises and tries to hold the head, pronounces fuzzy sounds (utters a mushy sound).
- 2 months: - long observes of moving toys, turns his head to the sound and begins to smile when speaking, holds the head while lying on his stomach, pronounces some sounds (utters some sounds). Baby sleeps 20 hours a day.

- 3 months: - carefully peers into moving bright objects, turns his head toward the sound, keep /hold/ his head in an upright position, often coo. Baby sleeps 18-19 hours a day.
- 4 months: - knows the mother, responds to music, try to take the toy, rests his feet in an upright position, utters various sounds.
- 5 months: - distinguishes relatives and intonation in his voice, rejoices children, takes their toys and keeps them; independently turn over from the back on his stomach, stands with support and sits; long hulyt; eats dense food with a spoon.
- 6 months: - responds to his name, takes toys, shift them to one's other arm, turns from the abdomen to the back, sits well, try to crawl, begins to babble, drinking from a cup. Baby sleeps 16-18 hours a day.
- 7 months: - plays with toys for a long time, well crawling, try to sit down, recognize things, long babble says syllables.
- 8 months: - plays with toys long time, repeats movements of adults, independently sits, lies down, knows own name, repeats syllables by adults.
- 9 months: - moves to the music, makes "good bye", repeats syllables from adult, sits on the potty. Baby sleeps 15-16 hours a day.
- 10 months: - performs various actions with toys at the request of an adult, walks, holding hands, gives known subject, repeats words.
- 11 months: - performs actions with toys on request, says first words.
- 12 months: - distinguishes objects, looking for toys by, yourself walks, says 8 - 10 words, independently drinks from a cup (takes and puts it).
- Child 1-1,5 years very active, curious, active gets acquainted with the world. Pronounces up to 20 words, he knows titles of many objects, body parts.
- Child to 1.5-2 years says short sentences well distinguish smells, noises and sounds. Willingly listens to music, self-eating spoon. Performs simple tasks, understand the ban. He walks alone, kneels to pick up a toy. Sleep is 14-16 hours a day.
- Child 2-3 years of contact, emotional, asks questions. Good runs, plays with small objects.
- In children 3-5 years speech becomes more diverse, there are personal opinions; character, manifestations of independence, stubbornness are formed. The child quickly learns words, foreign languages, painting and music.
- A child 6-8 years motor skills are well developed, transmits thoughts and impressions. They easily master skills of reading and writing.

COMPLAINTS

1. headache
 2. vertigo
 3. weakness
 4. violation of the sensitivity
 5. violation of intellectual
 6. weakening of memory
 7. sleep disorders
 8. change speech - retardation, stuttering,
 9. mood and behavior - irritability, tearfulness, change of mood
 10. Disorders of consciousness
 11. convulsions
 12. vomiting, nausea,
 13. paresis, paralysis, muscle weakness
 14. coordination of movements - walking, writing
 15. vegetative disorders - violation of sweating, thermoregulation, digestion.
- examination of the nervous system

Methods of children's nervous system examination

1. Overall assessment behavior

- Reaction to inspection
- Consciousness
- mood, attention, memory, speech

2. General inspection

A. body inspection

- Posture
- Coordination of movements
- Gait

B. The inspection head

- Position
- Shape, size, asymmetry

C. inspection of the face

- Ptosis
- lagophthalmos
- Strabismus, nystagmus, miosis

D. inspection of the trunk and extremities

- • Paresis, paralysis
- • hyperkinesis, spasms (tremor, athetosis, tic)

3. Investigation function of the cranial nerves
4. Investigation of superficial and tendon reflexes
5. Investigation of sensitivities

Surface sensitivity

- Pain
- Temperature

- Tactile
 - Deep sensitivity**
- musculo-articular
- vibrational
- sensitivity disorders**
- The quantitative - gipoesteziya, hyperesthesia, anesthesia
- The qualitative - dysesthesia, paresthesia, synesthesia, poliesteziya.
- Pain

5. Coordination of movements

6. Investigation of the vegetative nervous system

7. Pathological reflexes

Methods of children's nervous system examination

The first year of life children's state of nervous system is characterized by unconditioned reflexes which disappear with age.

**MINISTRY OF PUBLIC HEALTH OF UKRAINE
O.BOHOOLETSNATIONALMEDICALUNIVERSITY**

PEDIATRIC DEPARTMENT N5

"Approved"
on the methodical conference
Department of Pediatrics № 5
protocol №2 from 07.09.2016

**GUIDELINES
FOR STUDENTS**

Academic discipline	Pediatrics
Study subject	Anatomical and physiological peculiarities of respiratory system of children. Percussion of the lungs in pediatric practice. Semiotics of respiratory system diseases in pediatric practice.
Course	3
Faculty	Medical 1

Kyiv-2016

ANATOMIC AND PHYSIOLOGICAL PECULIARITIES OF THE CHILDREN'S RESPIRATORY SYSTEM. THE METHODS OF EXAMINATION. AFFECTION SEMIOTICS

relevance of the research. The respiratory pathology is one of the most often pathology in childhood, especially in the infants and toddlers. Knowledge of normal structure and function and of differences between childhood and adult respiratory systems is important for recognizing and understanding age-related diseases patterns and providing effective therapy.

The aim of the lesson: to study anatomic and physiological peculiarities of all the sections of the respiratory system, to master the methods of children examination, to study affection semiotics.

Anatomic and physiological peculiarities of respiratory organs of children.

Main functions of respiratory system in children:

- Breathing and gas exchange function
- Defence function
- Metabolic function
- Deposited function
- Filtrated function
- Endocrine function

Breathing and gas exchange function is the vital function of human. The gas exchange via alveolar-capillary membrane provides the supplying of human body the oxygen. The oxygen from the environment air goes through tracheal-bronchial tree into alveoli and exchange simultaneously with carbon dioxide from venous blood.

Embryogenesis of respiratory organs

- From the 3rd week of embryonic development begins the formation of respiratory organs and lasts a long time after the birth of a child.
- In the 3rd week of embryogenesis in cervical portion of entodermal tube appears a bulge, which grows rapidly. In the 4th week it divides into two parts- right and left - the future right and left lungs. Each of them in its turn branches up like a tree. Plain muscular fibers and cartilages of bronchi are formed of a mesodermal mesenchima.

- Canalicular phase (recanalization) lasts 16-26 weeks. This time takes place formation of holes in bronchi, continues development and vascularization of the future respiratory sections of the lungs.
- Completing phase (alveolar)- period of the formation of alveoli - begins in the 24th week. To the moment of the child's birth it does not finish and formation of alveoli continues also in postnatal period.

In anatomical structure respiratory organs are divided into:

- upper respiratory passages (nasal cavity, pharynx, larynx);
- middle respiratory passages (trachea, bronchi);
- lower respiratory passages (bronchioli, alveoli).

In children in different age periods are noticed peculiarities of respiratory organs structure.

Clinical examination of the respiratory system in children include

- history talking,
- inspection,
- palpation,
- percussion
- auscultation.

During the process of **anamnesis** it is necessary

- to find out the way the disease began;
- the first pathological symptoms appeared, their development and sequence - important presenting features of respiratory illness in children include cough, sputum, hemoptysis, dyspnea, chest pain, wheeze, and other forms of noisy breathing, weakness, pain in throat and chest, body temperature increasing, headache, appetite lowering, to make a detailed analysis of complaints, to evaluate the disease and life anamnesis;
- Other symptoms that may be of importance include hyperventilation, eczema, exanthems, and symptoms associated with gastrointestinal disease
- A history of recurrent or unusual respiratory infections, middle ear infections, or a previous history of croup can be clinically important and should be elicited. It is important to identify any exercise or sleep related symptoms. A complete history of respiratory health should include information about the child's past medical history, labour and delivery history, prenatal history, family history and social history. Information regarding allergies, medications and immunizations should be sought.

More often complaints in children who have respiratory troubles:

1. cough

2. catarrh
3. respiration rate or rhythm disorders
4. non-specific complaints.

The complaints are divided into two groups

- Specific complaints of

- cough,
- runny nose,
- shortness of breath,
- wheezing,
- cyanosis,
- pain in the chest when coughing and deep breathing,
- нарушениеbreathing rhythm, its depth,
- voice changes and the loss of its sonority

- Non-specific (complaints of a general nature), such as

- fever,,
- weakness, lethargy,
- loss of appetite,
- sleep disturbances,
- irritability,
- signs of intoxication.

EXAMINATION.

- the general condition of the patient,
- consciousness
- behavior (active or flaccid, retains an interest in the surrounding or indifferent)
- position (active, passive, involuntary). Forced position is observed in a fit of asthma, obstructive and asthmatic bronchitis, emphysema - patients trying to take a vertical position (sitting, leaning his hands on hips), and with the defeat of the pleura (effusion, lobar pneumonia) -dity lie mainly on the patient side.

Inspection of respiratory system consists of some steps:

- a) face inspection
- b) nose inspection
- c) neck inspection
- d) thorax inspection

Face inspection

- the patient's skin color.

- cyanosis of nasolabial triangle. Cyanosis is greatly enhanced in lung lesions during crying, swallowing ,.
- hyperemia of face
- pallor skin, gray -tinged skin
- how the child is breathing - nose or mouth. . Difficulty breathing through the nose can be associated with adenoid vegetation hyperplasia of the pharyngeal tonsils).
- rash (herpes etc.) on the skin and mucous membranes with viral respiratory infection, lobar pneumonia.
- discharge from the nasal passages and their character (watery, mucous, serous, mucopurulent, purulent, bloody, etc.), Unilateral purulent nasal discharge observed in the presence of a foreign body in the nasal passage. it is necessary to bear in mind the possibility of nasal diphtheria.
- cough – rhythm, character, tone, time and conditions for the occurrence,
 - paroxysmal, which is considered the main symptom of pertussis. The attack consists of a series of jolts cough continuously following each other and end convulsive breath. Most often, after a few seconds, starts the second the same whooping cough.
 - time of its occurrence. Thus, nocturnal cough is characteristic of patients with pertussis, sinusitis, and respiratory allergies, whereas in children with cystic fibrosis, bronchiectasis, chronic bronchitis most severe coughing happens in the morning.
 - If the cough is not accompanied by phlegm, it is called dry, as opposed to a cough with sputum production, which is called productive cough. Frequent dry, and short cough occurs in pharyngitis, and a deeper and more humid, in children with bronchitis and tracheobronchitis. Wet, deep and often painful cough occurs in children with pneumonia.
- state of the **mucous membrane of the throat**, soft and hard palate, tonsils.

On examination of the **neck area** in cases of severe respiratory lesions motion neck muscles can be seen in breathing

Next, examine the baby's **chest**.

- normal shape of the chest is cylindrical.
 - In emphysema, bronchial asthma, asthmatic and obstructive bronchitis, severe pertussis disease in acute form the chest becomes shorter and wider ("barrel-shaped").
 - Paralytic chest (decrease of all sizes, atrophy of the respiratory muscles, the sharp edges of the slope down "sharp epigastric angle blades lag) is typical of chronic bronchopulmonary processes.
- In healthy children thorax is symmetrical.
 - asymmetry observed in the case of unilateral chronic fibrotic process in the lungs, pleural effusion, pneumothorax, hemothorax.

- intercostal spaces in healthy children are the same size
 - In exudative pleurisy, hydropneumothorax spaces intercostal spaces are expanding,

Upon further examination of the chest one should define the character, depth, rhythm, and breathing rate, shortness of breath, supporting muscles participation in breathing.

Character breathing in children is estimated as

- calm, free - in healthy children
- difficulty (dyspnea)
- noisy, grunting, snoring, or heavy breathing,
- Wheezing

Disorders of the **respiratory depth**:

- Hyperpnea is an increased depth.
- Hypoventilation is a decreased depth and irregular rhythm.
- Hyperventilation is an increased rate and depth.

Pathological respiration

- Seesaw (paradoxical) respirations: the chest falls on inspiration and rises on expiration. It is usually observed in respiratory failure of third degree;
- Kussmaul's breathing is hyperventilation, gasping and labored respiration, usually seen in diabetic coma or other states of respiratory acidosis

rhythm (regular, irregular or periodic),

respiratory **rate** (number per minute).

A reasonable approach to taking the respiratory rate is the number of breaths in 15 seconds multiplied by 4.

Normal respiratory rate

Age Breaths /min

Infants (< 1 year) 30 – 60

Toddler (1-3 yrs) 24-40

Preschooler (4-5 yrs) 22-34

School age (6-12 yrs) 18-30

Adolescent (13-18 yrs) 12-16

Disorders of the respiratory rate:

- Tachypnea is the increase of the respiratory rate.
- Bradypnea is the decrease of the respiratory rate.
- Dyspnea is the distress during breathing.
- Apnea is the cessation of breathing.

Respiratory rate can change during the day (slows down during sleep) - depending on the season (in summer it increases), posture (slowing in the supine position).

Respiratory rate **increases** with

- exercise,
- psycho-emotional excitement,
- increased body temperature (at elevated body temperature by 1 ° C respiratory rate increases by 4-5 breaths), but these changes are temporary.

Slow breathing (bradypnoe) occurs in childhood rare. Its main reason - the oppression of function of the respiratory center, which may result from

- metabolic alkalosis (pyloric stenosis) and
- respiratory acidosis (severe intoxication, etc.)
- with significant metabolic disorders (uremia, hepatic failure, atonal period).

Rapid breathing in children is almost always accompanied by shortness of breath - **dyspnea**. Shortness of breath is a rapid and difficult breathing. Objective symptoms of breathlessness (**dyspnea**) are following

- changing rhythm
- respiratory rate
- participation in breathing auxiliary respiratory muscles.

Dyspnea divided into three types: inspiratory, expiratory, mixed.

expiratory dyspnea

the dyspnea is primary during the expiratory phase of respiration. Usually associated with lower airway obstruction.

inspiratory dyspnea

the dyspnea is primarily during the inspiratory phase of respiration. Usually associated with upper airway obstructions and sometimes disorders of the pleura.

Hindered noisy breath is typical for inspiratory dyspnea. Thus there is a whistling sound. It is observed in the presence of mechanical obstacles to the passage of air through the upper airway (true and false croup, laryngeal stenosis, foreign body in the trachea, retropharyngeal abscess).

Examination of the lungs in children

The lungs are situated inside the thoracic cavity, with one lung on each side of the sternum. Each lung is divided into an apex, which is slightly pointed and rises above the first rib, a base, which is wide and concave and lies on the domeshaped diaphragm, and a body, which is divided into lobes.

The right lung has three lobes: upper, middle, and lower. The left lobe has only two lobes, upper and lower, because of the space occupied by the heart. The two surfaces of the lungs are the costal surface, which faces the chest wall and backs up to the vertebral column, and the mediastinal surface, which faces the space lying between the lungs, the mediastinum. The center of the mediastinal surface is called the hilus where the bronchus and blood vessels enter the lung.

Palpation. Respiratory movements are felt by placing each hand flat against the back or chest with the thumbs in midline along the lower costal margin of the lungs. The child should be sitting during this procedure and, if cooperative, should take several deep breaths. During respiration the hands will move with the chest wall. The doctor evaluates the amount and speed of respiratory excursion, noting any asymmetry of movement. Normally in older children the posterior base of the lungs descends 5 to 6 cm (about 2 inches) during a deep inspiration.

The doctor also palpates for vocal fremitus, the conduction of voice sounds through the respiratory tract. With the palmar surfaces of each hand on the chest, the doctor asks the child to repeat words such as "ninety-nine", "one, two, three," "eee-eee" etc. The child should speak the words with a voice of uniform intensity. Vibrations are felt as the hands move symmetrically on either side of the sternum and vertebral column. In general vocal fremitus is the most intense in the regions of the thorax where the trachea and bronchi are the closest to the surface, particularly along the sternum between the first and second ribs and posteriorly between the scapulae. Progressing downward, the sound decreases and is least prominent at the base of the lungs. Crepitation is felt as a coarse, cracking sensation as the hand presses over the affected area. It is the result of the escape of air from the lungs into the subcutaneous tissues from an injury or surgical intervention. Both pleural friction rubs and crepitation can usually be heard as well as

felt.

Percussion.The lungs are percussed in order to evaluate the densities of the underlying organs. Resonance is heard over all the lobes of the lungs that are not adjacent to other organs. Dullness is heard beginning at the fifth interspace in the right midclavicular line. Percussing downward to the end of the liver, a flat sound is heard because the liver no longer overlies the air-filled lung. Cardiac dullness is felt over the left sternal border from the second to the fifth interspace medially to the midclavicular line. Below the fifth interspace on the left side, tympany results from the air-filled stomach. Deviations from these expected sounds are always recorded and reported.

In comparative percussing the chest, the anterior lung is percussed from apex to base, usually with the child in the supine or sitting position. Each side of the chest is percussed in sequence in order to compare the sounds.

The pathological dullness is heard in cause of

- a) pneumonia
- b) hydro-, haemothorax,
- c) pulmonary edema,
- d) lung or mediastinal tumor.

The banbox is heard in cause of:

- e) emphysema of lungs,
- f) cavern of lung,
- g) abscess of lung,
- h) pneumothorax,
- i) bronchial asthma,
- j) asthmatic bronchitis.

In topographic percussing the chest, the doctor looks for the lungs' borders in the main lines, the location of the apex of the lung and width of Crenig's areas. The topographic percussion is used only in children older 7 years old.

The line	The side	Age of child, rib	
		By 10 yr	Older 10 yr
Midclavicular	Right	VI	VI

	Left	-	-
Midaxillary	Right	VII-VIII	VIII
	Left	IX	VIII
Vertebral	Right	IX-X	X
	Left	X	X

In topographic percussion the margin of the lung is assessed from the side of resonance sound.

The upper margin of the lung (the location of the apex of the lung) is determined by percussions from the clavicle to the neck. The apex of each lung rises about 2 to 4 cm above the inner third of the clavicles in front of the body. At the back we examine the location of the apex of the lung by percussions from the scapula axis to the seventh cervical vertebra. Normally, the upper border of the lung is in the seventh cervical vertebra at the back.

Auscultation. Auscultation involves using the stethoscope to evaluate breath and voice sounds. Breath sounds are best heard if the child inspires deeply. The child can be encouraged to "take a big breath" by following a demonstration of "breathing in through the nose and out through the mouth." Younger children respond well to games such as blowing out the light from a cigarette lighter or the light of the otoscope.

In the lungs breath sounds are classified as vesicular or bronchovesicular. Vesicular breath sounds are normally heard over the entire surface of the lungs, with the exception of the upper intrascapular area and the area beneath the manubrium. Inspiration is louder, longer, and higher-pitched than expiration. Sometimes the expiratory phase seems nearly absent in comparison to the long inspiratory phase. The sound is a soft, swishing noise.

Bronchovesicular breath sounds are normally heard over the manubrium and in the upper intrascapular regions where there are bifurcations of large airways. Inspiration is louder and higher in pitch than that heard in vesicular breathing.

Puerile breath sounds are one of normal types of breathing in children from 6 months till 3 or 7 (if asthenic) years old. Puerile breath sounds have short inspiration and louder, a hollow expiratory phase, blowing character.

Another type of breathing is normal only over the trachea near the suprasternal notch is bronchial breath sounds. They are almost the reverse of vesicular sounds; the inspiratory phase is short and the expiratory phase is longer, louder and of higher pitch.

Rough breath sounds have short inspiration and louder phase. Rough breath has hollow and blowing character.

Absent or diminished breath sounds are always an abnormal finding warranting investigation. Fluid, air, or solid masses in the pleural space all interfere with the conduction of breath sounds (pneumonia pneumo-, hydro-, haemothorax, tumor of lung or mediastinal, emphysema of lungs, atelectasis, airways obstruction, a forcing body in the bronchus). Diminished breath sounds in certain segments of the lung can alert the doctor to pulmonary areas that may benefit from postural drainage and percussion. Increased breath sounds following pulmonary therapy indicate improved passage of air through the respiratory tract.

Voice sounds are also part of auscultation of the lungs. Normally voice sounds or vocal resonance is heard, but the syllables are indistinct. They are elicited in the same manner as vocal fremitus, except that the doctor listens with the stethoscope. Consolidation of the lung tissue produces three types of abnormal voice sounds – whisperer pectoriloquy, bronchophony and egophony.

Rales result from the passage of air through fluid or moisture. They are more pronounced when the child takes a deep breath. Even though the sound may seem continuous, it is actually composed of several discrete sounds, each originating from the rupture of a small bubble. The type of rales is determined by the size of the passageway and the type of exudate the air passes through. They are roughly divided into three categories: fine, medium, and coarse.

Fine rales (sometimes called crepitant rales) can be simulated by rubbing a few strands of hair between the thumb and index finger close to the ear or by slowly separating the thumb and index finger after they have been moistened with saliva. The result is a series of fine crackling sounds. Fine rales are most prominent at the end of inspiration and are not cleared by coughing. They occur in the smallest passageways, the alveoli and bronchioles.

Medium rales are not as delicate as fine rales and can be simulated by listening to the "fizz" from recently opened carbonated drinks or by rolling a dry cigar between the fingers. They are prominent earlier during inspiration and occur in the larger passages of the bronchioles and small bronchi.

Coarse rales are relatively loud, coarse, bubbling, gurgling sounds that occur in the large airways of the trachea, bronchi, and smaller bronchi. Often they clear partially during coughing.

Rhonchi are sounds produced as air passes through narrow passages, regardless of the cause, such as exudate, inflammation. Rhonchi are continuous, since sound is being forced past an obstruction.

Sibilant rhonchi are high pitched, musical, wheezing, or squeaking in character. The wheezing quality is often more pronounced on forced expiration. Sibilant rhonchi are produced in the smaller bronchi and bronchioles.

Sonorous rhonchi are low pitched and often snoring or moaning in character. They are produced in the large passages of the trachea and bronchi. Like coarse rales, they can be partly cleared by coughing.

During the examination – to evaluate the state of a sick child, the state of skin and pharynx, cyanosis presence, the form of chest (tubby, flattened out on one side, flatness of intercostal spaces and others), breathing (type, frequency, rhythm and deepness), the shortness of breath presence and character (inspiratory (Traube's) dyspnea, expiratory, mixed), the voice quality (husky, hoarse, nasal, aphonia), cough (character, pathognomonic, its frequency, deepness, rhythm, the prevailing time of day, etc).

During palpation – on pain, the voice trembling character, chest deformation, the skin wrinkle thickness symmetry, oedema and expansions of intercostal spaces, the pleural rubbing noise presence;

At the time of percussion – on the character of lung sound and its changes (shortening, atrophy, absolute dullness, tympanic, box-shaped), the pathological symptoms presence (Corani, Philosofov's bowl, Arkavin, Filatov, Maslov, Ellis-Damuazo-Sokolov line, Garlyand triangles, Grocco-Rahfus), lung boundaries changes;

During auscultation – on the type of respiration (vesicular, puerilistic, bronchial), the pathologic respiration types appearance (firm, weak, bronchial, amorphous), the presence and character of additional pathological noises (crepitation, pleural rubbing, bronchophony);

On the basis of the additional methods of investigation – to evaluate the clinic, biochemical, bacteriological, immunological, cytological data of blood investigation, phlegm, pleural

fluid, X-ray examination results, spirometry, peak flow meters, bronchoscopy, bronchography, computer and magnetic resonance tomography.

**MINISTRY OF PUBLIC HEALTH OF UKRAINE
O. BOHOMOLET'S NATIONAL MEDICAL UNIVERSITY**

PEDIATRIC DEPARTMENT N5

"Approved"
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Department of Pediatrics № 5
protocol №2 from 07.09.2016

**GUIDELINES
FOR STUDENTS**

Academic discipline	Pediatrics
Study subject	Anatomical and physiological peculiarities of cardiovascular system of children. Percussion of the heart. Semiotics of cardiovascular system diseases in children (cyanosis, bradycardia, tachycardia).
Course	3
Faculty	Medical 1

Kyiv-2016

Actuality of the theme Cardiovascular system provides delivery of oxygen and nutrients to all organs and tissues and removing of carbon dioxide and other metabolic products, and thus participates in the maintenance of a constant internal environment.

The purpose of classes. To learn anatomical and physiological characteristics of the cardiovascular system of the child at different stages of ontogenetic development, to be able to examine this system in children of different ages.

Intrauterine tab and differentiation of fetal heart and blood vessels

Embryonic formation of large vessels and the heart occurs from the 2nd week of fetal development from the double folds of mesoderm (primary heart tube) and clumps of cells that form the blood islands (primary blood vessels) to the active growth of these formations on the 3rd week and subsequent formation of the basic structures of heart.

Cardiovascular system is considered to be the first system that begins to function in the body of the embryo, and the complete structural formation of the heart ends in the 8th week of fetal development.

Therefore, the first three months of fetal development are considered to be the most unfavorable for the effects on the fetus of various pathogenic factors (physical, genetic, biological or chemical), which can break the complex mechanism of formation of the heart and major blood vessels. As a result of these influences congenital heart defects often appear.

Peculiarities of intrauterine blood circulation

Circulation of the fetus has a number of features in comparison with the functioning of the heart and blood vessels after birth.

These include:

- Absence of functioning of the lungs, so blood oxygenation occurs in the placenta;
- blood comes from the placenta to the fetus through the umbilical vein, and the passage of venous blood with carbon dioxide occurs through a system of umbilical arteries to the placenta;

- pulmonary circulation is absent, therefore blood is hardly goes to pulmonary vessels, and its main mass is discharged from the rising of the pulmonary artery into the aorta through the open ductusarteriosus, which closes after birth;
- foramen ovale (hole between the right and left atrium) is the second fetal shunt for reallocation arterial blood to all organs and systems of the fetus.

Changing blood circulation after birth

- umbilical veins, umbilical arteries and ductusvenosus stop functioning;
- gradual closing the patent foramen ovale and the ductusarteriosus is happening (their complete closure is observed 5-6 months to extrauterine life);
- After the baby is born, both circulation - systemic circulation and pulmonary circulation start to function fully

Basic anatomical and functional features of the of the heart in children

- the newborn heart is comparatively large, being about 0.8% (adult - 0.4%) by weight
- active development and improvement of structures from two to six years and adolescence.

Irregular growth of the heart is different at different age periods of the child:

- increase mostly the atria (up to two years of age);
- growth of the heart (up to ten years);
- intensive ventricular enlargement (over ten years).
- shape and location of the heart also change with the age.
 - The spherical shape of the heart is typical for young children
 - In infants the heart has a transverse disposition.
 - Heart takes a higher position, due to the high standing of the diaphragm.
 - With age, the heart becomes upright.
 - At the same time there is a slight turn to the left heart.
- among children up to the age of three rapid heartbeat (tachycardia) is detected, due to an active influence on the heart of the sympathetic nervous system;

Age	The pulse rate, in 1 min
Newbor	140-160

ns	
1 year	120
3 years	105
5 years	100
10 years	85
12 years	90

- in process baby growth (3-4 years) there is differentiation of the cardiac conduction system and the vagus nerve with preferential activation of the parasympathetic nervous system. With this age the gradual slowing of the heart rate is typical, there is respiratory arrhythmia, and in adolescence - different types of arrhythmias and blockades, which disappear with the development of the cardiac conduction system;
- Low blood pressure is typical for children, due to the small amount of blood that flows with each heartbeat, and greater width and elasticity of the arteries. Blood pressure in children less than adults. For approximate calculation of blood pressure (mm Hg. In.) In children older than 1 year can use the formula:
 - ✓ systolic blood pressure = $90 + 2n$,
 - ✓ diastolic blood pressure $60 + 2n$,
 - ✓ where n - age children in years.
- Newborn ratio of diameters of the pulmonary artery and aorta Other (aorta - 16 mm, pulmonary artery - 21 mm); aged 10-12 years, their diameter is the same as in adults aorta is always greater than the pulmonary artery (aorta - 80 mm, pulmonary artery - 74 mm).
- Newborn Blood vessels have thin walls, they are not sufficiently developed.
- The capillaries in children is well developed, wide and relatively short.

Physical Exam

The cardiac work-up of a heart patient begins with a series of questions during which important information is gathered. This may cover some, or all, of the following areas:

- Chief or predominant complaint
- Other heart related complaints
- Past illness or history
- Family history
- Review of systems or non-cardiac complaints
- Social history

Gathering complaints

CHIEF COMPLAINT:

The medical evaluation of a person with suspected heart disease begins with an interview about the patient's major complaint. The physician begins the process by asking specific questions about the complaint.

Complaints are divided into specific and nonspecific

Complaints of general (nonspecific) character:

- rise in temperature, fatigue, weakness,
- Headache, loss of memory, loss of appetite, loss of body weight,
- Sudden shout, anxiety of child,
- Flaccidity, flabbiness and pallor.
- Improper sucking: A child starts sucking breast, but after short time baby stops.
- Signs of weariness and dyspnea.

specific cardiac chief complaints can consist of

- shortness of breath,
- sweating
- dizziness,
- blackout spells,
- palpitations (a sensation of skipped, forceful, or fast heartbeats),
- dizziness
- nausea, vomiting
- Edema, swelling of the legs, etc.
- headache,
- discoloration of the skin (cyanosis, pallor)
- delays physical development of young children

The child of older age can present his/her complaints by himself/herself:

- Pain on the area of heart. In this case it is necessary to specify:
 - Character of pain – sharp, blunt, burning, stabbing.
 - Time when it appears – at night, in the afternoon, constant, after neuro-psychological stress or physical exercises or in a state of connection of pain with position of the patient – change in pain while getting up, in position on the left or right side.
- Irradiation of the pain – especially to the left hand.
- Cardiac dyspnea *which leads to take deep breath, stop during climbing, sometimes with groaning.*
- Perceptible heartbeat (in a state of rest or during physical exertion).

While gathering anamnesis of disease it is necessary to ask the parents in details about the **dynamics of disease** from the moment it started:

- ✓ when and which symptoms appeared first,
- ✓ how they changed (for example if the parents

- Significant cyanosis or pallor of the skin, delay in physical development of children from birth, shortness of breath, which appears with little physical exertion (screaming, crying, feeding, etc.), frequent bronchopulmonary diseases are the most typical signs of **congenital heart defects and vascular lesions** (defects in the atrial and ventricular septa, patent ductus arteriosus, coarctation of the aorta, transposition of the great vessels, et al.).
- Complaints rapid pulse, palpitations, cardiac arrhythmias, including dyspnea on exertion, the presence of cyanosis nasolabial triangle, sometimes the pain the heart may indicate a **myocarditis**.
- In **paroxysmal tachycardia** children may complain of agitation, shortness of breath and sometimes vomiting, the appearance of a cold sweat.
- Children with high (**hypertension**) or low (**hypotension**) blood pressure often complain of headache,
- Complaints of shortness of breath, even with little physical exertion or at rest, expressed skin cyanosis, edema of the extremities that are growing in the evening, typical of **circulatory failure** in children.

PAST HISTORY:

After obtaining information about the chief complaint, the physician will inquire about the past history.

Anamnesic:

A complete history is essential regardless of the type of heart defect. The major categories to investigate include a history of:

- Poor weight gain, poor feeding habits, and fatigue during feeding
- Frequent respiratory infections and difficulties
- Cyanosis with or without clubbing of fingers
- Evidence of exercise intolerance in addition,
- a history of previous defects in a sibling,
- maternal rubella infection during pregnancy, or associated chromosomal abnormalities, such as Turner's or Down's syndrome
- In rheumatic fever a history of a previous streptococcal infection is of primary importance.

FAMILY HISTORY:

Certain cardiac illnesses such as coronary artery disease and high blood pressure may occur in more than one member of a family. Therefore, the physician will inquire about the health of the patient's parents, brothers, sisters and children. Similarly, risk factors for coronary artery disease, such as diabetes, high cholesterol, etc., may be prevalent in the same family.

Physical examination

Examination of the heart involves the skills of

- inspection,
- palpation,
- percussion, and
- auscultation, although the latter is the most significant.

General inspection

- evaluate general state of the sick child,
 - its position in the bed,
 - reaction to the environment, physical development,
 - color of the skin and visible mucous membranes (lips, conjunctivitis, etc.)..
- When **syndrome circulatory failure**
 - ✓ general condition of the child severe,
 - ✓ The child chooses a forced position - Half-upright using pillows in bed,.
 - In cases of **cardiac decompensation patient** takes a sitting position, legs down from the bed (orthopnea), based on planted under the back pillow (blood is deposited in the lower extremities, reducing congestion in the pulmonary circulation, and shortness of breath).
 - Children with **pericardial effusion**, sitting in a greatly flexed position (knee-elbow), thereby reducing the acute pain in the heart.
 - In patients with **coarctation of the aorta** there is a disproportion of the upper and lower parts of the body. These children have a overly developed shoulder girdle, while the pelvis and lower limbs are underdeveloped.

Skin and mucous membranes.

Diffuse cyanosis of skin and mucous membrane has a central origin and arises as a result of insufficient blood oxygenation in the pulmonary circulation, observed in patients with

- pulmonary artery stenosis, Fallot's disease,
- transposition of the great vessels.

peripheral cyanosis

- occurs when poor circulation
- its development is determined by the high content of reduced hemoglobin and tissues with slow circulation, especially in the difficulty of venous circulation
- the most distinct in remote areas of the heart (fingers, toes, tip of the nose, ears)

Face inspection

- confusion, suffering, fear in his eyes with a sharp pain in the heart (facial expression)
- very severe pallor of skin with aortic heart defects

Neck inspection

- pulsing and bulging of the carotid arteries ("carotid dance") is observed on the medial m.sterno-cleido-mastoideus with aortic valve insufficiency and widely opened ductusarteriosus.
- synchronic shake of head with pulsation of the carotid arteries (Mussel's sign).
- pulsation of the jugular veins
It appears laterally from m.sterno-cleido-mastoideus with stagnation of blood in the upper abdominal vein

Inspection of the chest

- «heart hump", which appears in infants with congenital or acquired heart disease (cardiac hypertrophy). He also formed when cardiomegaly and myocardial hypertrophy.
- diffuse pulsation of the heart - "cardiac impulse" and apical impulse (beat)

subcutaneous vessels

reinforced *venous network* of the anterior abdominal wall

inspection of the upper and lower extremities.

- cyanosis
- *marble skin pattern*
- shape of the terminal phalanges of fingers and toes - drum sticks and nails - in the form of watch glasses).

Palpation. Palpation is needful fir determine the size of the heart. The apex is usually at a lower interspace and more lateral in a child with cardiac enlargement. The apex is felt by placing the fingertips or the palmar aspect of the fingers and hand at the fifth intercostal space and left midclavicular line. Assessing the quality and symmetry of all pulses. Pulse-altering, large, swift, dicrotic, intermittent, labile, small, slow, soft, tense, rhythmic, rapid, pulse deficit, pulse flutter, tension of the pulse, full (weak) pulse, pulse rhythm, beatings of the pulse, pulse rate.

Average pulse rates at rest (per minute)

Newborn	140-160
6 months	130-135
1 year	120-125
2 years	110
3 years	105
4 years	100
5 years	98-100
6-7 years	90-85
10 years	78-85
12 years	70-75

Determine blood pressure.

Percussion.

Border's of hearts relative dullness

Border	age of child			
	until 2 years	2-7 years	7-12 years	older 12 years
Right	right parasternal line	right parasternal line or something inward from right parasternal line	Between the right parasternal line and the right sternal line	the right sternal line
upper	the II rib	the II intercostal space	the III rib	the III intercostal space
Left	2 cm outward from left midclavicular line	1 cm outward from left midclavicular line	0,5 cm outward from left midclavicular line	0,5 cmmedially from left midclavicular line
transversal size	6-9 cm	8-12 cm	9-14 cm	9-14 cm

Border's of hearts absolute dullness

Border	age of child			
	until 2 years	2-7 years	7-12 years	older 12 years
Right	left sternal line	left sternal line	left sternal line	left sternal line
upper	the II intercostal space	the III rib	the III intercostal space	the IV rib
Left	1.0-0.5	left midclavicular	Between the left	left

	cm outward from left mid- clavicular line	line	midclavicular line and left parasternal line	parasternal line
transversal size	2-3 cm	4 cm	5-5.5 cm	5-5.5 cm

**MINISTRY OF PUBLIC HEALTH OF UKRAINE
O. BOHOMOLET'S NATIONAL MEDICAL UNIVERSITY**

PEDIATRIC DEPARTMENT N5

"Approved"
On the methodical conference
Department of Pediatrics № 5
protocol №2 from 07.09.2016

**GUIDELINES
FOR STUDENTS**

Academic discipline	Pediatrics
Study subject	Anatomical and physiological peculiarities of digestive system in children. Methods of clinical examination of digestive system (inspection, palpation, percussion, auscultation). Semiotics of digestive system diseases in children. Abdominal syndrome.
Course	3
Faculty	Medical 1

Kyiv-2016

Anatomical features of the digestive system in children.

Actuality of theme. The digestive system in children has certain anatomical and physiological characteristics. Knowledge of these features helps the doctor in the treatment and prevention of digestive diseases in children of different ages.

The purpose of classes. To learn the anatomical and physiological characteristics of the digestive system; master the methods of examination of children; to study the semiotics of diseases of this system

In the **embryo**, the primitive digestive tract is a tube evolving from three separate parts: the foregut, the midgut and the hindgut which develop separately from the yolk sac. The foregut gives rise to the pharynx, lower respiratory system, oesophagus, stomach, first and second sections of the duodenum, liver, pancreas and biliary apparatus. The midgut gives rise to the duodenum through to the transverse colon. The hindgut develops into the rest of the large intestine to the anus. Due to herniation of the midgut into the umbilical sac at week six to ten of foetal life, the mesentery, which is a skin keeping all the gut in position, is fixed at the top in the left upper quadrant of the abdominal cavity by the ligament of Treitz and at the bottom in the right iliac fossa.

The digestive system is a group of organs working together to convert food into energy and basic nutrients to feed the entire body. Food passes through a long tube inside the body known as the alimentary canal or the gastrointestinal tract (GI tract).

The digestive system is divided into **two major parts**:

- The digestive tract (alimentary canal) is a continuous tube with two openings: the mouth and the anus. It includes the oral cavity (mouth), pharynx, esophagus, stomach, small intestine, and large intestine. Food passing through the internal cavity, or lumen, of the digestive tract does not technically enter the body until it is absorbed through the walls of the digestive tract and passes into blood or lymphatic vessels.
- Accessory organs include the teeth and tongue, salivary glands, liver, gallbladder, and pancreas.

Peculiarities of all parts of digestive system in infant

The oral cavity of the child

- It is relatively small, filled by tongue.
- The tongue is short, wide and thick.
- Lips and cheeks are relatively thick, with well-developed muscles and thick fat buccal fat pad.
- On the gum there are thickenings, also play a role in the act of sucking.

The mucous membrane of the oral cavity

- Is tender, is richly supplied with blood vessels and relatively dry.
- Dryness due to insufficient development of the salivary glands and saliva deficiency in children under 3-4 months of life. The mucous membrane of the mouth is easily vulnerable that should be considered when carrying out the toilet mouth.
- Development of the salivary glands is completed by 3-4 months, and increased salivation begins with this time (physiological salivation).
- The saliva reaction in infants is neutral or slightly acid.

The pharynx in infant

- It is relatively wide and short.
- The oral part is on the same level as oral cavity.
- The baby can't breath and swallow the food at once.

Esophagus.

- Entrance to the esophagus in the newborn is at the level III and IV cervical vertebrae, in 2 years - at the level of IV-V cervical vertebrae, in 12 years - at the level of the vertebrae VI-VII.
- The length of the esophagus in the newborn is 10-12 cm, in the age of 5 - 16 cm;
- It is relatively narrow. its width is 7-8 mm in newborn, to 1 year - 1 cm and 12 years - 1.5 cm
- Anatomical narrowing of the esophagus in newborns and infants are underdeveloped.
- absence of glands, and the insufficient development of the musculo-elastic tissue.
- The mucosa of the esophagus is tender and has a good blood supply.
- the esophagus enters the stomach in all periods of his childhood at X -XI thoracic vertebrae.

Stomach

- In infants, the stomach is horizontally, but as soon as the child begins to walk, it takes a more upright position.
- By the birth of a child's bottom and fore-stomach are underdeveloped, and pyloric department - is much better, it explains the frequent regurgitation.
- Capacity neonatal stomach - 30-35 ml, in 1 year it is increased to 250-300 ml, 8 years - 1000 ml.

- The mucous membrane of the stomach is tender, rich in blood vessels, poor elastic tissue, has a few digestive glands.
- The muscle layer is underdeveloped.
- Has insufficient secretion of gastric juice, which has a low acidity. Gastric secretory apparatus in infants are underdeveloped and functional ability of its is low.
- The stomach has two main functions - secretory and motor. Total acidity in the first year of life is 2.5-3 times lower than those of adults, and is 20-40.
- The first months of the life motor function of the stomach is poorly developed, peristalsis is weak. In infants increase in the tone stomach muscles in the pylorus may often, the maximum manifestation of which is pylorospasm.

RESEARCH METHODS OF DIGESTION

Inquiries

On questioning is necessary to pay special attention to the complaint.

Painful syndrome.

- Manifestations of abdominal pain in infants is a common anxiety, crying, children move their feet. In older children, the equivalent of the early pains can be early satiety in the meal and the overflow of the stomach. In the presence of abdominal pain should clarify their character.
 - Localization (preschool children with abdominal pain usually point to the navel).
 - Irradiation - the spread of pain beyond the projection of the affected organ).
 - Character (colicy, dull, aching, pulling, sharp pain.).
 - Frequency (alternating periods of pain and good health).
 - Seasonality (occurrence or increased pain in the spring and autumn period).
 - Connection with the quality and quantity of food.
 - Time of appearance (during a meal, early pain - after a 30-60 minutes after eating, pain later - after 1.5-3 hours after eating, hunger pains - 6-7 hours after ingestion and disappear after the meal; night pain - there are in the range between 23 hours and 3 hours after the morning meal disappear).

Dyspeptic syndrome

- **Nausea** is an unpleasant sensation in the epigastric region, accompanied by weakness, sometimes vertigo, pale skin, hypersalivation.

- **Vomiting** is the eruption of stomach contents out. Variety of vomiting young children - regurgitation, which occurs without tension abdominal muscles. When collecting anamnesis should be clarified features of vomiting,
 - the time of its occurrence (on an empty stomach in the morning, immediately after a meal, after 1, 5-2 hours after a meal, while pain)
 - frequency;
 - the amount of vomitus, their smell, color, consistency,
 - food residues and the presence various additions.
 - to find out Whether it brings relief.
- Eructation (gas discharge from the stomach into the mouth with food sometimes gruel). It is necessary to identify the triggers of its factors (overeating, exercise, eating certain foods), frequency.
- **Heartburn** (sensation of burning behind the breastbone and epigastric). It is necessary to take into account its frequency of occurrence (episodically, several times day); connection with the intake of certain foods (spicy, acidic, greasy, coarse) or medicines, with body position.
- **Changes in appetite:** its decrease, absence, increased appetite - bulimia, perversion (eating nonedible substances -. chalk, lime, ash, etc.), early satiety.
- **Constipation** - absence of defecation for more than 36 hours.
- **Diarrhea**(diarrhea) - frequent evacuation of intestines with a change in the nature faeces (from pasty to watery).
- Violation of swallowing (dysphagia) may manifest
 - difficulties in swallowing,
 - phobia swallowing food,
 - pain or discomfort during the passage through the esophagus food regurgitation (regurgitation)
 - food aspiration.
- **Thirst** - the subjective feeling of the need for water.

Intoxication syndrome

Complaints related to **chronic intoxication** - fatigue, muscle weakness, and various neurotic disorders (irritability, insomnia, tearfulness, and others.).

Fever occurs in acute inflammatory affection of the gall bladder and bile ducts, in abscess, in hepatitis, and active cirrhosis.

Skin itching attends hepatic or obstructive jaundice. It can develop without jaundice, as an early forerunner of the liver disease. Itching is caused by accumulation in the blood of bile acids

Icteric discolor of the skin and the visible mucosa (jaundice) is due to accumulation of bile pigments in the blood and tissues.

Enlargement of the abdomen can be due to accumulation of ascitic fluid in the abdominal cavity (in obstructed blood outflow from the intestine via the portal vein), in considerable meteorism, or in pronounced hepato- or splenomegaly.

History of illness

The history of the disease the doctor find out the initial signs of the disease, its the duration, frequency relapse periods, duration of remission, dependence on the changing features of the food and life, from the previous and treatment of diseases, etc. Take into account the data from previous clinical-laboratory and instrumental studies and the effect of the applied before treatment.

Examination of the abdomen

Normally, the stomach has a round symmetrical shape. The degree of active participation of abdominal muscles in breathing should be evaluated.

Superficial palpation of the abdomen is performed from the left groin in symmetrical areas of the left and right side, rising to the epigastric region;

The features revealed by superficial palpation.

- ✓ painfulness (projection area indicates a pathological process in the appropriate body).
- ✓ Resistance (slight muscle tension) abdominal muscles, indicating a possible involvement in the inflammation of the peritoneum. Thus it is necessary to check symptom Shchetkina-Blumberg
- ✓ significant increase abdominal organs (liver, spleen) or the presence of a large tumor

Deep sliding palpation allows to conclude that some of the properties of the abdominal cavity. The doctor determines the location and extent of palpable body, its shape, size, texture (soft, dense), the surface of the character (normally a smooth, sometimes bumpy), mobility (normally different intestine motility), pain

and rumbling (normally not available). In healthy children, in most cases it is possible to test the sigmoid colon, blind gut and transverse colon,

Necessary condition is the maximal relaxation of muscles, especially front abdominal wall.

The following sequence of **deep palpation** is recommended:

- the left ileum area – the sigmoid
- the right ileum area – the cecum with the terminal end of the ileum
- the ascending colon,
- the transverse colon
- the descending colon,
- further the epigastric and paraumbilical regions - the stomach with its parts (greater curvature and pylorus) and;
- the following stage - palpation of the liver, the spleen and kidneys.

The deep sliding palpation is performed only after the surface tentative palpation of an abdomen. Palpation should be carried out by the right hand. Palpation can also be bimanual (palpation with both hands simultaneously).

Deep sliding palpation technique involves four rules

- position of the doctor's hands. The right hand is placed on the anterior abdominal wall parallel to the axis of the examined part or the margin of the examined organ.
- formation of folds of skin in order to facilitate further movements of the examining hand.
- moving the hand inside the abdomen. Deep palpation is performed when the fingers are moved gradually with each of expirations, into the abdomen when the abdominal wall is relaxed. The examining hand thus reaches the posterior wall of the abdomen or the underlying organ.
- sliding movement of the fingertips in the direction perpendicular to the transverse axis of the examined organ. The organ is pressed against the posterior wall and the examining fingers continue moving over the examined organ. The examining hand should always move together with the skin and not over its surface.

Palpation of sigmoid

Palpation is performed by four fingers, placed together and slightly flexed.

- **Sigmoid colon** is palpated in the left iliac region in the form of a moderately dense smooth cord with a diameter of 2-3 cm, not grumbling
- The **cecum** has a form of a smooth soft elastic cylinder with a diameter of 3-4 cm. It is slightly extended from top to bottom (pear-shaped extension), which ends blindly. When pressed rumbling occurs
- In the right iliac region terminal ileum can sometimes be palpated as a cylinder of soft elastic consistency with a diameter of 1-1.5 cm; well grumbling palpation.

Ascending and descending colon sections are arranged longitudinally accordingly in the right and left side areas of the abdomen. They are mobile and moderately dense painless cylinders with a diameter of about 2 cm

- The transverse colon is palpated bimanually by four fingers of the right and left hand held together and slightly flexed. The transverse colon is palpated in umbilical region in the form of a cylinder, curved arc down, moderately dense, with a diameter of about 2.5 cm, not grumbling

The gallbladder is not normally accessible to palpation. Projection gall bladder to the anterior abdominal wall corresponds to the place of the intersection external side of the right rectus abdominis muscle with rib arc (gallbladder point). A number of symptoms can indicate a disease of the gallbladder.

- Symptom Kera - the appearance of a sharp pain in point of the gallbladder at the height of inspiration during normal palpation gallbladder).
- Symptom Murphy (strong and sharp pain at the moment of inspiration immersion doctor fingers in the projection area of the gall bladder, which causes the patient to terminate inhalation).
- Symptom Ortner - pain in the right upper quadrant when effleurage edge of his hands alternately on both rib arcs).

- Symptom of George-Musso (frenikus-symptom) - pain at the point of the right phrenic nerve. It was detected by pressing your fingers in an interval between the stalks of both sternocleidomastoid muscle

Pain points in diseases of the pancreas

- Point de Jardin - it is located on the line that connects the navel with the top of the right armpit, at a distance of 4-5 cm Indicates the disease of the head duodenum.
- Kach's Point – is located external edge the left musculus rectus at 4-7 cm above the navel. Indicates the disease body and tail duodenum
- Point Mayo-Robson – is located on the border of the external and middle thirds of a line connecting the navel to the middle of the left costal arch
- Chauffard Zone - between the vertical line passing through the navel and bisectrix the angle formed by the vertical and horizontal lines passing through the navel. Soreness in the area most is typical of inflammation in the pancreatic head;

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PEDIATRIC DEPARTMENT N5

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**GUIDELINES
FOR STUDENTS**

Academicdiscipline	Pediatrics
Studysubject	Anatomical and physiological peculiarities of urinary system in children. Methods of clinical examination of urinary system. Semiotics of urinary system diseases in children. Syndrome of acute and chronic renal failure.
Course	3
Faculty	Medical 1

Kyiv-2016

Anatomical and physiological features of urinary system in children.

THE RENAL (URINARY SYSTEM) consists of two kidneys, one urinary bladder and one urethra. The kidneys constantly filter the blood plasma (filtrate) through capillary networks called glomeruli and return most of the water and solutes back to the blood throughout the tiny filtering tubules called nephrons

The renal system is critical to the healthy function of all body systems.

Functions of kidneys

1. Excretory function
 2. Homeostatic — maintenance of a constant internal environment of an organism (pH, water-salt, protein, fat, carbohydrates exchange, temperature, osmotic pressure, etc.).
 3. Secretory.
- **Waste excretion:** The kidneys filter out toxins, excess salts, and **urea**, a nitrogen-based waste created by cell metabolism. Urea is synthesized in the liver and transported through the blood to the kidneys for removal.
 - **Water level balancing:** The kidneys conserve or eliminate water, which regulates the volume of blood in the.
 - **Blood pressure regulation:** The kidneys regulates the blood pressure in 3 ways:
 - Adjusting the volume of blood in the body by regulating of quantity of water in the blood
 - Adjusting the flow of blood both into and out of the kidneys
 - By the action of enzyme renin. The kidneys secret renin which activate the angiotensin-aldosterone system
 - **Red blood cell regulation:** The kidneys contribute to the production oxygen-carrying red blood cells by releasing the hormone **erythropoietin** that stimulates erythropoiesis.
 - **Synthesis of vitamin D** - the final derivation of the active form of vitamin D₃ — promotes the absorption of calcium into the intestines.
 - **Acid regulation:** As cells metabolize, they produce acids. Foods we eat can either increase the acid in our body or neutralize it. If the body is to function properly, it needs to keep a healthy balance of these chemicals. The kidneys do that, too.

Embryogenesis renal system

The system develops from the intermediate mesoderm on either side of the dorsal (back) body wall, which gives rise to three successive nephric structures (filtering units) of increasingly advanced design. The kidney changes three times before it is completed

Renal function starts to develop in foetal period and continues to evolve throughout the first years of life until it reaches its complete, adult level. The human kidney begins to develop in the 5th gestational week and starts to produce urine between the 10th and 12th week of gestation. Nephrogenesis is complete around the 35th- 36th week so that a term neonate is born with all its nephrons

Anatomical and physiological features

- The weight and size of kidney in young children is relatively larger than that of older children and adults.
- that results in a low topographic location of the kidneys in children during the first years of life. The upper pole is at XI-XII thoracic vertebra and the bottom - at the level of the top edge of the lumbar vertebrae IV, ie below the crest of the ilium. This feature disappears to 7 years.
- In younger age groups the kidneys are more mobile than adults. This is due to poor development of their perinephric fat, renal fascia
- In the first years of life have a kidney lobed structure
- cerebral cortical layer dominates
- The morphological maturation of cortical ends to 3-5 years, and the kidney as a whole - school age.
- a large number of glomerular unit volume of kidney tissue
- The diameter of glomeruli is much smaller

Functional features of the kidney

- Since the birth of the kidneys begin to perform homeostatic function.
 - The filtration capacity of a newborn kidney is low. This is due to: the small size of the glomeruli; low hydrostatic pressure
- urinary tract**
- urinary tract in younger children have insufficient development of muscle and elastic tissue.
 - renal pelvis is relatively wider than in adults,
 - The ureters move away from them at right angles. The ureters are relatively longer, wider, hypotonic, more convoluted.
 - The bladder in infants is higher than in adults (over the symphysis), with age it gradually descends into the pelvis. Physiologic bladder capacity of a newborn is about 50 ml, 1 year of age - 100 ml in 5-9 years - 150-200 ml in 12-14 l of a 300-400-ml.
 - Urethra (urethritis) in girls at all age periods are shorter and wider than in boys.

Physical examination

Examination of urinary organs includes questioning the child and his parents, inspection, palpation, percussion, laboratory and instrumental methods of research.

Questioning

Complaints

- Pain in the abdomen, in the lumbar region.

- Dysuric disorders: frequent or rare urination, painful urination, enuresis (urinary incontinence),
- Swelling of the face, legs.
- Increased blood pressure, sometimes accompanied by headache, vertigo, pain in the heart.
- Changing the appearance of urine (opacification, the appearance of a precipitate, a color change).
- temperature rise - febrile or a low grade fever (subfebrile).
- Visual, hearing impairment.
- Dyspeptic disorders (nausea, vomiting, decreased appetite, diarrhea), thirst, itching of the skin.
- Weakness, flaccidity, undue fatigability, weight loss.

Anamnesis of disease

Special attention is necessary for diseases, which, probably, the child had 10-15 days before pathology of kidneys developed (acute tonsillitis, pneumonia, scarlatina, etc.). Because these diseases can be a trigger for the development of renal disease.

Inspection

At examination of the patient it is necessary to estimate the following signs:

- *Consciousness.*
- *The behavior — at a renal colic the child rushes about, can not be quiet.*
- *The position in bed — a characteristic sign of the purulent — inflammatory process in the perirenal fatty body is the forced position, when the child lies sideways, the legs are bent at the knee and coxofemoral joints and are put closer to the trunk.*
- **Pallor of skin.** It appears due to spasm of the arterioles or accession anemia. Pale with icterus typical of uremia (in this case, there are scratches on the skin ecchymosis, furred tongue, the smell of ammonia from the mouth or on the skin of the patient). Waxy pallor is typical for renal amyloidosis.
- **Edema (or pastosity) on the face and extremities** Edema can be: general (anasarca); with the accumulation of fluid in the cavities: abdominal (ascites), pleural (hydrothorax) and pericardial (hydropericardium). You can see the puffiness of the face, swelling of the eyelids, narrowing palpebral fissures (facies nephritica), the smoothed outline of the joints, lumbar lordosis, traces of pressure clothes, sheets.

If you suspect a hidden edema is necessary to weigh the baby daily, Daily measure diuresis

- **Changing the size and shape of the abdomen**The abdomen increases in volume with ascites
Protrusion in the suprapubic region at the expense of the overflow of the bladder is observed in acute urinary retention.
Swelling of the lumbar region on the affected side is observed at paranephritis
- **disembriogenetic stigma.** Most frequently encountered in children with genetic nephropathy, kidney malformations and urinary tract development

Palpation and percussion

Taking into account the age features of the position of the lower pole of a kidney, It becomes clear that normally it is possible to palpate this organ only in children of the first 2-3 years of life. At senior age the kidney can be palpable only, in case of its increasing (tumor, stones of kidneys) and displacement downwards.

Methods of the conjoined manipulation

1. Method of Obratsov-Strazhesko:

- The position of the child is horizontal.
- The doctor is on the right side of the patient.
- As you have already learnt method of palpation of the organs of the abdominal cavity, the legs of the child are a little bent and are slightly abducted (this movement partially relaxes the muscles of the abdominal wall).
- The patient does regular respiratory movements.
- **Palpation of a right kidney:**
 - The left hand of the doctor is under the trunk in the projection of a right kidney (along the waist).
 - The right hand of the doctor lies flat lateral from the right rectus muscle of the abdomen (in a parallel way to it), the fingers are posed a little bit below from the right costal arch.
 - In such a position, during the process of exhalation, the right arm gradually goes deeper inward. The palm of the left hand is simultaneously raised upwards, which promotes the approximation of the kidney to fingers of the right hand. Thus, in case of possible palpation of kidneys the right hand at the beginning feels the lower pole of a kidney. Further sliding movements estimate the sizes, form, mobility, morbidity, consistency, possible roughness of the wall of the right kidney.

The palpation of a left kidney the technique corresponds to the above described, with one exception: the left hand will be carried on further under the trunk up to the projection of a left kidney, the right one is allocated outside, in the area of the left musculus rectus abdominis.

The objective sign obtained in diseases of the renal system is the detection by palpation of the 'pitting' edema.

One of the first, quite objective in pediatrics, professionally favorites of the doctors among clinical signs of diseases of kidneys is the **Pastematsky's symptom** defined with the help of the method of slight beating as percussion. The essence of the method consists in the arising of the pain in the location of kidneys.

General urinalysis

Urinalysis includes the determination of the physical properties and chemical composition of urine and its sediment microscopy.

The technique of urine collection: it is necessary to explore the morning urine first micturated (urination) (middle urine stream), collected after a careful toilet of external genitals. In newborns and infants urinals are used for urine collection, which is attached to the crotch of the child

feature	norm
Colour	A straw yellow (depending on the content in it mainly urochrome, urobilin)
Transparency(Clarify/turbidity)	transparent
urine reactionpH	Slightly acidic or neutral The reaction of urine in infants is acidic (pH 5,4-5,9), further depends on the type of feeding - breast-pH is 6,9-7,8; - Artificial - 5,4-6,9 (ie urine of children is characterized by a physiological acidosis)
Specific gravity	1,002-1,030
Protein	≤ 0.033 g / l
Glucose	Less than 0.1% of glucose normally filtered by the glomerulus appears in urine (< 130 mg/24 hr). Glycosuria (excess sugar in urine) generally means diabetes mellitus.

<p>Organic elements of urinary sediment:</p> <ul style="list-style-type: none"> • erythrocytes • leukocytes 	<p>0-2 in sight</p> <p>0-4 in sight</p>
Inorganic urinary sediment	<p>The peculiarity of Urinary sediment depends on the colloidal state, pH and other properties of urine</p> <p>Newbornsurinalysis is character-rized by sediment of <u>uric acid</u>.</p> <p>At older ages, the prevalence of <u>uric acid</u> in the urine sediment is formed in the excessive use of meat-eating, physical activity, fever, fasting,</p> <p>Oxalates (crystals) are present in the urine in the excessive use of foods rich in oxalic acid</p>
EpithelialCells	<p>Renal tubular epithelial cells, usually larger than granulocytes, contain a large round or oval nucleus and normally slough into the urine in small numbers. However, with nephrotic syndrome and in conditions leading to tubular degeneration, the number sloughed is increased.</p> <p>Transitional epithelial cells from the renal pelvis, ureter, or bladder have more regular cell borders, larger nuclei, and smaller overall size than squamous epithelium.</p> <p>Squamous epithelial cells from the skin surface or from the outer urethra can appear</p>

	in urine.
Casts	Urinary casts are formed only in the distal convoluted tubule (DCT) or the collecting duct (distal nephron). The proximal convoluted tubule (PCT) and loop of Henle are not locations for cast formation. Hyaline casts are composed primarily of a mucoprotein (Tamm-Horsfall protein) secreted by tubule cells. Hyaline casts can be seen even in healthy patients.

One of the most widely used methods for defining the number of blood cells (and hyaline cylinders) in urine are the methods of Nechiporenko, Hamburger, Addis sediment count.

Nechepurenko's method

This method determines the amount of leukocytes and erythrocytes (and cylinders) in 1 mL of urine. The rules of collection: the middle portion of the first morning micturated urine, not less than 10 ml, is collected in a clean vessel.

The normal parameters are:

- Leukocytes — not more than 4000 in 1 mL of urine
- Erythrocytes — not more than 1000 in 1 mL of urine
- Hyaline cylinders — not more than 250 in 1 mL of urine

The urinalysis by Hamburger (Ambyrze's method)

(French nephrologist of the 20th century)

This method determines the amount of blood cells in urine which are passed out within 1 minute.

The rules of collecting urine for the analysis:

- On the eve the child should not take a lot of liquid and should not drink anything during the night.
- The first morning micturation should not be taken (it is also possible to use this urine for general urinalysis, by Nechiporenko), the time of the first micturation is precisely noted.
- After 3 (!) hours all the urine passed by the child is collected in a clean vessel and sent to the laboratory.

The normal parameters are:

Leukocytes	not more than 4000
Erythrocytes	not more than 1000
Hyaline cylinders	not more than 250

The interpretation of the results is similar to the analysis of results by Nechiporenko.

Addis sediment count

(U.S. doctor of the 20th century)

This method determines the amount of blood cells and cylinders in the 24 hours amount of urine.

The rules of collecting urine for the analysis:

- On the eve the child should take more protein rich food, less liquid and should not drink anything in night.
- In the evening before sleeping it is necessary to note the time of the last micturation.
- Then during 12 hours it is necessary to collect urine in one vessel (in the laboratory the calculation will be done for 24 hours).

The normal parameters are:

Leukocytes	not more than 4 000 000
Erythrocytes	not more than 1 000 000
Hyaline cylinders	not more than 20 000

The significance of every investigation is in the order seen above: the analysis by Nechiporenko is more precise, than general urine test, the analysis by Hamburger is more objective, as compared to the method of Nechiporenko, and the Addis sediment count is most reliable (this method is useful at diagnosing the latent forms of pyelonephritis and glomerulonephritis).

Possible versions of the analysis:

- Considerable leukocyturia. may be insignificant hematuria and cylindruria — the sign of pyelonephritis.
- Considerable hematuria (less expressed leukocyturia) and cylindruria — the signs of glomerulonephritis.
- Considerable leukocyturia (hematuria may be present), and cylinders in normal quantity — often the sign of inflammation of the urinary tracts.

Bacteriological examination of urine

Inoculation morning urine collected in a sterile container is performed.

After 24 hours, a qualitative and quantitative assessment of the results carries out. Type of pathogen and its sensitivity to antibiotics identify.

Pathological bacteriuria is considered when determining the more than 10^4 microbial bodies in 1 ml of urine in infants and young children, and more than $0,5-1,0 \times 10^5$ - in older children.

Functional kidney tests

The study of renal function allows to judge the location and the severity of structural damage of the parenchyma.

Zymnyckiy's test

Collect 8-portion urine while 24 hours; from 6 o'clock (this portion do not take). While every 3 hours to the 6 p.m. of other day.

The presence of portions with a specific gravity of 1,018 or more indicates the normal concentration ability. The difference between the maximum and minimum specific gravity of 0,010-0,012 units indicates the normal kidney's ability to concentrate and dilution. Daytime diuresis of a healthy child is $2/3 - 3/4$ of the daily

**MINISTRY OF PUBLIC HEALTH OF UKRAINE
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PEDIATRIC DEPARTMENT N5

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Department of Pediatrics № 5
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**GUIDELINES
FOR STUDENTS**

Academic discipline	Pediatrics
Study subject	Breastfeeding
Course	3
Faculty	Medical 1

Kyiv-2017

NATURAL FEEDING BABIES

Breastfeeding is the normal way of providing young infants with the nutrients they need for healthy growth and development. Virtually all mothers can breastfeed, provided they have accurate information, and the support of their family, the health care system and society at large.

Exclusive breastfeeding is recommended up to 6 months of age, with continued breastfeeding along with appropriate complementary foods up to two years of age or beyond.

Exclusive breastfeeding

Exclusive breastfeeding is defined as "an infant's consumption of human milk with no supplementation of any type (no water, no juice, no nonhuman milk, and no foods) except for vitamins, minerals, and medications." National and international guidelines recommend that all infants be breastfed exclusively for the first six months of life. Breastfeeding may continue with the addition of appropriate foods, for two years or more. Exclusive breastfeeding has dramatically reduced infant deaths in developing countries by reducing diarrhea and infectious diseases

Why breastfeeding is important

1. Early breast milk is liquid gold – Known as liquid gold, colostrum (koh-LOSS-trum) is the thick yellow first breast milk that mother make during pregnancy and just after birth. This milk is very rich in nutrients and antibodies to protect baby.
2. Breast milk changes as baby grows – Colostrum changes into what is called mature milk. By the third to fifth day after birth, this mature breast milk has just the right amount of fat, sugar, water, and protein to help baby continue to grow. It is a thinner type of milk than colostrum, but it provides all of the nutrients and antibodies baby needs.
3. Breast milk is easier to digest – For most babies — especially *premature* babies — breast milk is easier to digest than formula. The proteins in formula are made from cow's milk and it takes time for babies' stomachs to adjust to digesting them.
4. Breast milk fights disease – The cells, hormones, and antibodies in breast milk protect babies from illness. This protection is unique; formula cannot match the chemical makeup of human breast milk. In fact, among formula-fed babies, ear infections and diarrhea are more common.

The stages of lactation can be summarized as follows (adapted from Riordan and Auerbach, 1998)

- Mammogenesis: Mammary (breast) growth occurs. The size and weight of the breast increase.
- Lactogenesis
 - Stage 1 (late pregnancy): Alveolar cells are differentiated from secretory cells.
 - Stage 2 (day 2 or 3 to day 8 after birth): The tight junction in the alveolar cell closes. Copious milk secretion begins. Breasts are full and warm. Endocrine control switches to autocrine (supply-demand) control.
- Galactopoiesis (later than 9 d after birth to beginning of involution): Established secretion is maintained. Autocrinesystemcontrolcontinues.
- Involution (average 40 d after last breastfeeding): Regular supplementation is added. Milksecretiondecreasesfromthebuildupofinhibitingpeptides.

As known from Table, the contents of the basic ingredients present in the mother's milk considerably changes in the neonatal period in the life of the infant.

Table

Amount of ingredients (g) and its caloric contents in (kcal) 100 ml of milk

Kind or milk		Components			Caloric
		Proteins	Fats	Carbohydrates	
Mother'	Colostrum	7-5	2.0	4-5	150
	Transitive	2.5	3.2	5.5-6.6	60-80
	Mature	1.1-1.5	3.5-	7	65-70
Cow's milk		2.8-3.5	3.2-3.5	4.5-4.8	60-65

Cow's milk-

- **No antibodies** – Antibodies that are in breast milk are not in cow's milk / formula and cannot be artificially produced.
- **Water** – The amount of water in cow's milk / formula can't change to suit your baby's need the way breast milk can.
- **Fat** – The fat in cow's milk / formula is very different than the fat in breast milk and your baby can't absorb it as easily.
- **Protein** – The amount of protein in cow's milk / formula is at least double the amount in breast milk and is also a different and less digestible type.
- **Carbohydrates** – Cow's milk / formula has smaller amounts of carbohydrates than breast milk.
- **Vitamins and minerals** – Cow's milk / formula has more of some vitamins and minerals and less of others than breast milk; it's not the right amount for your baby.
- There are over 100 ingredients in breast milk which ARE NOT in formula, even

the new "DHA added" formulas. Formula is intended as a replacement for breastmilk when breastmilk is not available, but sadly, it does not even come close to it!

Nutritional composition of breast milk

Fats

The fat content of human milk is 4-4.5gm/100ml, more in hind milk, the fatty acid composition is about 42% saturated, and 57% unsaturated and rich in long chain polyunsaturated fatty acids which are important in brain development and myelination. Human milk contains a non-specific bile salt stimulated lipase and contributes to the infant's fat digestion.

The nutritional composition of breast milk begins with fat. If you take all the water out of breast milk, half of what's left behind is fat. And, there's lots of cholesterol too. But babies, infants, and young children need fats because it is needed for the development of the nervous system. Specifically, fats are need to cover & protective nerve cells. They are also integral parts of cell membranes.

In breast milk, there is an enzyme called lipase. Lipase breaks down fat so that the fat is in small globules. This allows for better digestion and absorption in Baby's stomach.

In contrast, the fat globules in baby-formula are large because they are from cow's milk (cow's milk is used to make most formulas). The fat from cow's milk is not absorbed as well by human babies. Formula manufacturers have tried to correct this by replacing cow's milk fat with plant oils (corn, coconut, olive, peanut, and others).

Carbohydrates

The next big component of breast milk is carbohydrates (37%). Most people know carbohydrates as the macromolecule found in bread, pasta and rice. But in breast milk, most of the carbohydrates are in the form of lactose. The major carbohydrate in the human milk is lactose, about 7gm/100ml. Lactose is a disaccharide: it is made up of two sugars (galactose and glucose) linked together. It is metabolized into glucose and galactose, a constituent of galactolipids needed for the development of CNS.

It facilitates calcium and iron absorption and promotes intestinal colonization with *Lactobacillus bifidus* – Lactose is converted to lactic acid by the *Lactobacillus* (a naturally occurring gut bacterium). In human milk also is sucrose, fructose and maltose, which stimulate the growth of *L. bifidus* and is called bifidus –factor. *L. bifidus* maintains an acid milieu in the gastrointestinal tract, inhibiting the growth of pathogenic bacteria, fungi and parasites. *L. bifidus* makes Baby's stomach acidic and maintains an acid milieu in the gastrointestinal tract, inhibiting the growth of pathogenic bacteria, fungi and parasites that are not supposed to be in Baby's stomach.

Lactose furnishes about 40% of energy needs. Lactose provides Baby with energy so that he can do the things that babies do: breath, eat, cry, wriggle, poop, learn, grow, and develop.

Cow's milk (used to make baby formula) has less than 10% lactose. Formulas manufacturers try to match the nutritional composition of breast milk by adding more lactose.

Proteins

There are high levels of protein in colostrum and the levels gradually decrease as Baby grows older and older. By six months of age, Baby should get an external source of protein, for example in baby cereals or other solid foods.

Mature human milk contains protein in the range of 1.3 to 2.07gm/100ml. Mature milk has many different kinds of proteins but the two major players are whey and casein. The whey casein ratio is roughly 80:20. Whey is a smooth, liquidly-type of protein whereas casein is a coarse protein that tends to curdle. In breast milk, 60% to 80% of the proteins are of the whey type. The lactalbumin results in formation of softer gastric curd, reduces gastric emptying time and that's why whey is easier to digest and it is absorbed well in Baby's stomach. Because of this, babies fed on breast milk will have runny poops, and be hungry more often.

Cow's milk has more casein and less whey. Casein is harder to digest & absorb because it clumps in Baby's stomach. Formula-fed babies are hungry less often because the formula isn't being digested. As well, when the Babies poop, the poops are more solid. Formula manufacturers try to correct for this by adding emulsifiers to help break apart the casein.

The human whey mainly consists of alpha-lactalbumin but other than whey and casein, there are many other important proteins:

- antibodies (helps fight against bacterial and viral infections),
- lactoferrin (binds to iron and helps Baby absorb iron. It also prevents the growth of harmful microorganisms that use iron),
- bifidus factor (encourages the growth of lactobacillus which helps prevents the growth of other harmful stomach bacteria),
- lipase, amylase, lysozyme, and other enzymes (helps in digestion and creates a healthy environment in Baby's intestines). The lactalbumin is an important component of the enzyme system in lactose synthesis.

Human milk also has higher levels of free amino acids, cystine and taurine.

Vitamin

The vitamin concentrations in human milk are almost always adequate for infants' need. The mineral concentration is lower in human milk than the cow's milk and is thus better adapted. Calcium is more efficiently absorbed because of high calcium: phosphorus ratio (2:1). The bioavailability of iron is high.

Human milk is protective and immunomodulatory. The anti-infective properties in colostrum and breast milk have both soluble and cellular Components. The soluble components include immunoglobulins (IgA, IgM, IgG), lysozymes, lactoferin, the bifidus factor. The cellular components include macrophages, lymphocytes, neutrophil granulocytes and epithelial cells. The concentrations of these constituents are very high in colostrum, decreases in mature milk, which is due to dilution effect by increasing milk volume.

Milk from cows and goats is quite different in composition than human breast milk and, therefore, should not be fed to human infants. Human milk, which is designed specifically for promoting infant health, is much lower in protein, calcium, and sodium, and higher in mono- and polyunsaturated fats, carbohydrates, folate, and vitamin C.

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**GUIDELINES
FOR STUDENTS**

Academic discipline	Pediatrics
Study subject	<i>Methods of calculating the daily volume of food and diet. Bait feeding (complementary feeding) and nutrition correction. Daily requirement of the child for food ingredients and energy.</i>
Course	3
Faculty	Medical 1

Kyiv-2016

Ways of breast feeding:

For the fully appropriate child's feeding providing, it is necessary to keep to the rules that assist the increased lactation among women. They are:

Feeding schedules

1. **Demand** (free) feeding – that is feeding, when infants signal readiness. The free feeding assists the relations establishment between mother and a child as for the lactation rhythm; that is why, if a child is sound, it is not recommended to limit the feeding regime, its time must depend on the child's need in food.

2. **Scheduled** feeding – arranged at predetermined intervals to meet family routines. Sometimes scheduled feeding can be used in bottle-fed infants, but today pediatricians recommend feeding all children in demand (free) regime.

The **term of the first time** of breast giving has an important meaning for the lactation establishment and the best time for it are the first 30-40 minutes after birth. If there are no contra-indications by mother's and child's health, it is recommended to leave the child with mother for an hour; then newborns are to be kept in the same room with mothers and get mother's breast any time they need it.

Routine (Mode) of infant feeding

After a normal delivery the newborn was first applied to the breast in the delivery room. Within 2-3 months, the child usually receives food after 3 hours, the baby is fed seven times a day: 6.00, 9.00, 12.00, 15.00, 18.00, 21.00 and 24.00. After this last night-time – 6 hours. If your baby wakes up at night crying newborn can feed at night. Gradually, the baby will disturb less and night for 2-3 months will not be waking up at night.

When the baby suckles as often and as long as he wants, is considered the most efficient in the first months of life. This mode of feeding is free. The number of feedings may be 8-12 times during the day

In the third month of life the baby starts to get breast milk in 3.5 hours, ie 6 times a day: 6.00, 9.30, 13.00, 16.30, 20.00 and 23.30. Night-time - 6.5 hours.

With 5 (6) months of age, when to introduce solid foods until the end of 1 year of age interval between feedings increased to 4:00 and the child to eat food five times a day: 6.00.10.00,14.00,18.00 and 22.00. Night-time - 8:00.

0-3 months of age	4-6 months of age	6-12 months of age
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6-00		6-00		6-00	
9-00	7	9-30		10-00	
12-00	times a day	13-00	6	14-00	5
15-00	or	16-30	times a day	18-00	times a day
18-00	free feeding	20-00		22-00	
21-00	-	23-30		.	
24-00	/on demand/			Night-time	
Night-time - 6 hours		Night-time - 6.5 hours		- 8 hours	

The calculation of the necessary amount of food eaten by the child

For approximate calculation of the necessary amount of breast milk the child at the age of 7-10 days, we can use of several ways.

Complementary feeding is the process starting when breastmilk alone or infant formula alone is no longer sufficient to meet the nutritional requirements of an infant. All infants should continue to receive breast milk for at least the first year and preferably for the second, but other, more nutritious foods should be added by the time an infant reaches six months of age.

Complementary foods - a gradual replacement of milk cooked food. The need /necessity/ for feeding is justified as follows:

- the number of mother's milk is reduced Gradually;
- human milk provides a child with ingredients only until 5 months, breast milk cannot provide all of the nutrients and calories that allow infants to thrive after the first six months of life need for minerals increases and plant foods have minerals;
- For the proper functioning of the gastrointestinal tract needs fiber, which is not present in breast milk;
- Chewing (mastication) during feeding - a factor in the proper development of the apparatus of speech;

Guiding principles for appropriate complementary feeding

1. continue frequent, on demand breastfeeding until two years old or beyond;
2. Complementary feeding can be started only when the child is healthy
3. first cooked food is given before breast-feeding, then the baby is fed breast milk.
4. start with small amounts of foods - 15-20 ml and increase gradually: *In the days of feeding the input increases to 20-30 ml.*
5. One breast is replaced by cooked food for 2 weeks
6. Only one feeding in the diet is replaced by cooked food, the other 4 times the baby gets breast milk
7. cooked food should be homogenous

1.First Complementary food (Solid foods) is given at 6 months

- first solid foods is given in the form of vegetable puree.
- At first, the potato is used, a week later other vegetables are added - carrots, zucchini, cabbage (one form per week)
- At 6 months, you must add in the mashed vegetable oil, for 6-7 months – butter. Crackers, cookies are introduced into the diet (the amount is gradually increased from 3-5 g to 10-15 g at the end of 1 year of age). In 7 months the child receives bread - from 5 g to 10 g.

2.Second Complementary food is given at 7 months

A second feeding is introduced in the form of milk porridge. The most rational are the following cereals: rice, buckwheat (born buckwheat), corn (born maize, corn).

3. At the 7th month of vegetable foods is expanded and becomes dinner, i.e. soup: the child receives a low-fat meat bouillon (60-70 ml), minced meat (chicken, pork, beef). Starting with small portions - 5 g, single dose minced meat gradually increases to 20-30 gr. The total amount of food equal to 200 ml - 120 ml vegetable puree, 50 ml of meat bouillon and 30 g meat
4. At the age of 7-8 month baby is introduced into the diet **third III Complementary food** - Low-fat cottage cheese (30 g and 50 g by the end of 1 year), and yogurt;
5. At the age of 10 months of life baby can be given a second time on the day of porridge, but from the other croups (cereals).

Образец листа питания ребенку 6,5 месяцев:

6.00	10.00	14.00	18.00	22.00
breastmilk — 200 мл	Vegetable puree -200 мл	breastmilk — 200 мл	Milk rice porridge - 200 мл	breastmilk - 200 мл

Fruit, berry and vegetable juices start to give a child at the age of 5-6 months. Usually start with apple juice, made from non-acidic yellow-green varieties of apples. Juice is introduced very carefully, slowly with increasing volume. Children with intestinal colic and other symptoms of digestive dysfunction, it is advisable to give the juice of 1/2 or 1/3 diluted with water. Juices of citrus, "exotic" fruits (mango, Guay, papaya, etc.), raspberry, strawberry, tomato relate to products with high potential allergenic and so it is better not to apply.

Fruit puree. The first fruit is apple puree, then assortment is expanded, using the combined fruit and fruit and berry puree of different kinds of fruits and berries.

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**GUIDELINES
FOR STUDENTS**

Academic discipline	Pediatrics
Study subject	<i>Artificial and mixed feeding. Contraindications to natural feeding. Types of formula.</i>
Course	3
Faculty	Medical 1

Kyiv-2016

ARTIFICIAL AND MIXED FEEDING

Unfortunately, there are some limitations to the breastfeeding.

The main indication for mixed and artificial feeding is hypogalactition (agalactia) in the mother. However, the transition to these types of feeding should be only when the entire arsenal of measures to stimulate lactation, has no effect, and restore full milk production is not possible.

Other indications for artificial feeding are the following contraindications to breastfeeding.

Contraindications for breastfeeding.

Mother's side is:

1. malignant neoplasms; chemotherapy/radiation
2. Psychological disorders (acute mental illness) as epilepsy, schizophrenia, depressive psychosis, postpartum psychosis.
3. chronic heart, kidney, liver, pancreas, at the stage of decompensation.
Breastfeeding can be continued in the compensation stage of the disease.
4. The most dangerous infections (tetanus, anthrax,).
5. Hepatitis C in the active phase of the disease;
6. HIV-positive serological reactions.

Ways of HIV transmission from mother to child:

- transplacental - 10-15%
- intrapartum - 70-75%
- Through breast milk - 10-12%

According to WHO experts in the case of breastfeeding HIV-positive mothers are infected every seventh child. For the prevention of perinatal transmission of HIV from mother to child are important:

- determination of the HIV status of the pregnant woman, which is carried out 2 times during pregnancy
- timely antiretroviral therapy and prophylaxis for HIV-positive mothers and their newborns (Retrovir, AZT, Viamune)
- optimal (right) choose the type of infant feeding

HIV can be transmitted through breast milk. HIV infection is a contraindication to breastfeeding.

7. Active forms of tuberculosis in the mother: the child must be separated at birth from his mother and removed from the home environment for 1.5-2 months. This period is necessary in order to immunity produced after TB vaccination. They are fed **expressed milk**;
8. syphilis infection in the mother after the 6-7th month of pregnancy; syphilis as a rule, syphilis infection is not a contraindication to breastfeeding. If the infection

occurred after 6-7 months of pregnancy and the baby born with no signs of syphilis, it is necessary to prohibit the feeding.

9. viral hepatitis, typhoid, smallpox, salmonella, dysentery,
According to many authors if the mother has HIV infection, typhoid fever, salmonellosis, dysentery child can feed sterilized **expressed breastmilk**.
10. measles, chicken pox. In this case it is possible to use a breast feeding the child after the **introduction of gamma globulin** and subject to the epidemic regime.
11. in case SARS, bronchitis, pneumonia, you need to temporarily stop breast-feeding until reduce the temperature and toxicity in the mother
12. Taking certain medications-cytostatics, hormones, tranquilizers
13. Substance-abuse (drugs, alcohol, marijuana, cocaine, heroin, etc)
14. Mastitis (an inflammatory disease of the breast).

Chronic persistent herpes infection in the mother is not a contraindication to breastfeeding. Herpes simplex viruses type I and II breast milk is not transmitted. At the same time a newborn baby receives antibodies of immunoglobulin class Ig G, that will cause the immune protection of the child in the first months of life.

Chronic persistent cytomegalovirus infection is not a contraindication to breastfeeding

Child's side is:

In the neonatal period, there are some serious pathological condition of the child, which is prohibited by sucking the breast, but breast milk is not prohibited. In these cases, children are fed expressed milk or milk donors

1. severe disorders of cerebral circulation,
2. profound prematurity with the lack of swallowing and sucking reflexes
3. severe respiratory distress. These children maintained breast feeding - they are fed your **expressed breast milk**.
4. Some congenital disorders are absolute contraindications- phenylketonuria, galactosemia, Lactose intolerance

If mother don't breastfeed, for whatever reason, then baby will need infant formula milk.

Artificial feeding is a type of feeding, the child in the first half of the year did not receive breast milk, but it is fed only formula milk versus. If the child receives the first months of life, at least 20% of the daily diet of breast milk, this type is also called artificial feeding.

Mixed feeding is a kind of feeding a child during of the first months of life receives artificial infant formula with breast milk.

Infant food manufacturers and health care professionals are united in recommending breast milk as the best way to feed a baby during the first six months of life. However, because a woman cannot, or chooses not to breast feed, then the infant formula is used. There are clinical or pathological cases, which permits only the infant formula to be used and this is a very good reason why the infant food industry makes an essential contribution to infant and young child health by offering safe and nutritious alternatives to breast milk.

At artificial feeding baby instead of breast milk gets specially prepared mixes, which are divided into 2 groups:

- adapted formulas
 - Highly adapted formulas
 - Less adapted formulas
 - partially adapted formulas
- Non-adapted

Infant formulas are also divided on

- fresh (пресные) mixture and
- acidophilus (Fermented milk or sour (acidic) milk) mixture.

Formulas for artificial feeding are

- standard
- specialized.

Standard mixtures - is adapted to preparations based on cow's milk. Special blend made for special categories of children: premature babies, children - allergies, children born with low birth weight, children suffering from food intolerance, vomiting, delayed stool etc. These mixtures should appoint a pediatrician, watching over the health baby.

Adapted milk formula

1. Highly adapted formulas.

The main advantage of adapted formulas is that they are on the composition of proteins, fats, carbohydrates, vitamins, minerals similar to breast milk. Adapted formulas often are made from cow's milk. In some countries this purpose a mare, goat and camel milk are used. These mixtures are prepared on the basis of dry whole milk, non-fat cow's milk. A certain amount of demineralized whey is added to cow's milk that can enrich the mixture more valuable proteins, albumin and globulin, and reduce the total amount of more crude protein casein which predominant in cow's milk. They are used for children with neonatal period to 4-5-6 months.

- "Nutralon", "Neonatal" (Holland)
- "Nan", "Alfaro" and "Alprem" (Switzerland)
- "Prehipp" and "hippie-1" (Austria),
- Tutelli ("Valio")
- "Enfamil-1" (Holland / USA)

- "Pre-Heinz" (USA),
 - "MCA" (USA),
 - "Bona" (Finland),
 - "Peak" (Slovenia)
 - "Semper Baby" ("Semper Foods and Co", Sweden)
 - "Heinz" (England)
 - "Humana" (Germany).
 - Ukraine - "Baby", "Malyatko-M", "Babe", "Vitalakt", "Detolakt";
2. Less adapted mixture. They are made on the basis of dry and nonfat cow's milk, in which the main protein is casein and demineralized whey is not added. Therefore, such a mixture of at least close to the protein composition of breast milk.
- "Similac", "Similac with iron" (USA),
 - "Impress" (Germany)
 - "Enfamil", "Enfamil with iron," "Enfamil-2" (Holland / USA)
 - "Nutrilon-2."
- In contrast to the first type of mixtures used from birth to 4-5 months, the second group is recommended for children from 5 to 6 months of age
3. Partially adapted mixture. These products do not contain such dietary supplements as taurine, choline, a number of fatty acids. Demineralized whey is absent, the fatty acid composition is not fully balanced, and as a carbohydrate component, except lactose, sucrose and starch are also used. This group of compounds include:
- "Baby",
 - "The Kid" (Ukraine, Russia)
 - "Detolakt", "Sun", "Vitalakt-DM", "Vitalakt enriched", "Vitalakt-M" (Ukraine)
 - "Milumil" (Germany)
 - "Milazan" (Germany).

Adapted sour formula

Different yeast is used for the preparation of fermented mixtures - Kefir fungus, bifidobacteria, acidophilus.

Adapted sour mixtures are optimal chemical composition and contain *Lactobacillus acidophilus*, *Bifidobacterium* and other lactic acid bacteria, which have antagonistic activity against pathogenic and opportunistic microorganisms and thus have a protective effect.

Advantages

- mixture easier to digest because the protein in them is partially digested by fermentation.
- less than sweet mixture to cause allergic reactions in children.

These are the following a mixture - "Vitalakt", "Nutrilon", «NAN-sour-milk», etc.

Non-adapted infant formula

Non-adapted infant formula - is food a child 1 year of age, made with fresh or dried milk of animals without any special processing.

Non-adapted sweet formula

Sweet non-adapted infant formula - it is usually diluted animal milk. In our country the most commonly used milk.

Non-adapted sourformulais kefir (yogurt) diluted with rice water, acidophilus milk, formula "Biolakt", etc. They are made from whole cow's milk by fermentation it by lactic acid bacteria. The main disadvantage of yogurt is that it is very different from human milk in composition of essential nutrients, ie, is not adapted to human milk.

Non-adapted infant formula should not be used as a staple food for the baby.

Adapted formulas are the most rational nursing 1st year of life in artificial feeding.

**MINISTRY OF PUBLIC HEALTH OF UKRAINE
O. BOHOMOLET'S NATIONAL MEDICAL UNIVERSITY**

PEDIATRIC DEPARTMENT N5

"Approved"
on the methodical conference
Department of Pediatrics № 5
protocol №2 from 09.09.2016

**GUIDELINES
FOR STUDENTS**

Academic discipline	Pediatrics
Study subject	<i>The organization principles of nutrition and children older than 1 year.</i>
Course	3
Faculty	Medical 1

Kyiv-2016

It is important in this period to form the child's principles of healthy nutrition, in the future will contribute to its healthy development and preservation of health. The process of formation of skills healthy eating will be more successful if the nutrition of the whole family will comply with these principles.

Children over the age of one can eat food that adults eat from the family table. Recommended number of feedings for a child is at least 5 times a day - three basic and two additional reception.

Basic principles of healthy eating of a child aged 1-3 years

- 1) breastfeeding should be continued in the second year of life .
- 2) The child's diet should be varied and should contain fresh vegetables and fruits daily.
- 3) Low-fat meat, fish, liver, eggs are recommended.
- 4) The dishes should be soft, mushy homogeneous consistency in the form of mashed potatoes, soufflé, meatballs, steamed chops,
And fruits and vegetables are finely chopped. With the appearance of molars children, food consistency may be as in adults.
- 5) At 2 years of age, milk and dairy products should have regular fat content (3.2% or 3.5%), And for children older than 2 years milk and dairy products with low fat content are recommended. In the diet, fermented dairy products should be used
- 6) For the prevention of iodine deficiency, when cooking, iodized salt should be used.
- 7) Food should be carefully cooked and given to the child no later than 30 minutes after cooking.
- 8) Meat is used at least 5 times a week, 1 day can be vegetarian and 1 day - fish
- 9) In the diet we should use vegetables, dill, parsley, green onions, garlic, spinach once a day
- 10) breakfasts and dinners should be warm and quite large - 200-250 ml staple food plus warm drinks - 100-150 ml
- 11) Second breakfast and afternoon snack - warm drink (compote, milk, sweet tea) in the volume of 100-150 ml plus biscuits, cottage cheese, crackers, pies 50 grams

Time of feeding	Daily caloric needs	Time of feeding	Daily Caloric Needs	Type of food	
1-1.5-year old	110/kg	1.5-3-year old	100/kg		
8 - 8 ³⁰	20%	8 - 8 ³⁰	25%	First breakfast	
11 a.m	15%	-----		second breakfast	
13 -13 ³⁰	30%	12-12 ³⁰	35%	Dinner	
16-00	15%	16-00	15%		
19-19 ³⁰	20%	19-19 ³⁰	25%	Supper	

Recommended products per day

Milk - 500 ml

Cottage cheese - 30 -40 g

Meat - 50-60 g

Eggs - 1

Juice - 100 ml

Fruit (berries) - 100 g