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ANATOMICAL AND PHYSIOLOGICAL FEATURES OF ORGANS AND SYSTEMS IN CHILDREN

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Annotation

This manual is devoted to such issues as the anatomical and physiological characteristics of organs and systems in children, as well as the assessment of clinical symptoms of childhood diseases, and the semiotics of diseases. This material is enriched with drawings, tests and situational tasks are presented in accordance with modern requirements, which helps students to independently acquire knowledge.

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Foreword

INTRODUCTION

The study of the anatomical and physiological characteristics of organs and systems in children is the main task of the subject of pediatric propaedeutics, which plays an important role in the preparation of a pediatrician. Propaedeutics of pediatrics is a transitional stage from fundamental theoretical disciplines to clinical ones. Anatomical and physiological characteristics of children - age-related features of the structure and function of the body as a whole and its systems and organs. Knowledge and consideration of these features are necessary for the correct diagnosis.

The most obvious indicators of physical development are the annual changes in the height and body weight of the child. These indicators indicate that the process of physical development of children proceeds unevenly, in waves: at one age, growth is accelerated (the child's body is stretched in length), at another, on the contrary, body weight increases markedly while its growth slows down.

According to these indicators, the following periods of bodily development of children can be distinguished:

1) the period of the first rounding (from 1 year to 4 years), which is characterized by an annual significant increase in weight with a relatively small increase in body length;

2) the period of the first extension (from 5 to 7 years), characterized by a noticeable increase in body length with a relatively slight increase in its weight;

3) the period of the second rounding (from 8 to 10 years); 4) the second stretching period (11 to 16 years) and 5) the third rounding or maturation period (16 to 20 years).

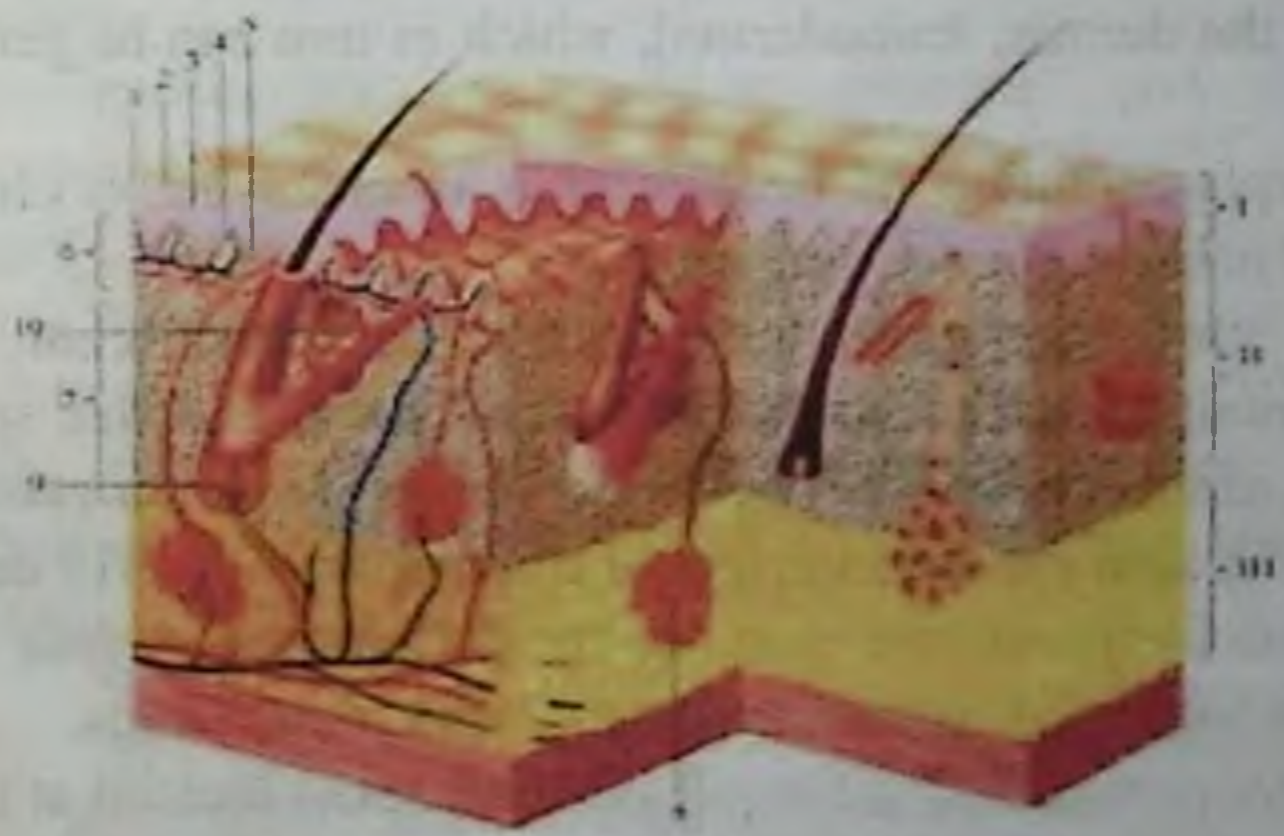
In the 3rd year of medical school, students should be able to differentiate the symptoms and syndromes of diseases, as well as study the growth and development of the child's body, and age characteristics.

All this basic knowledge - the laws of growth and development of children, the causes and mechanisms of the development of diseases, and methods for their detection, treatment, and prevention - are a solid foundation for "Pediatrics".

1. ANATOMICAL AND PHYSIOLOGICAL FEATURES OF THE SKIN IN CHILDREN

The skin is richly vascularized (Rice 1).

- Thin, smooth, delicate, elastic.
- The sebaceous glands begin to function even in utero.
- Sweat glands are poorly functioning in the early years.
- The skin is covered with vellus hair.
- Nails are well developed.
- Low protective function of the epidermis.
- The pigment-forming function is reduced.
- The excretory function is imperfect.
- Thermoregulatory function is reduced.
- The respiratory function of the skin is well expressed.
- Synthetic function is fully developed (vit.D synthesis).
- The skin is sensitive to irritants, infections.



Picture 1. The structure of the skin

Semiotics of skin lesions

- Paleness.
- Hyperemia.
- Violation of pigmentation.
- Jaundice.
- Cyanosis (central, peripheral, local).
- Violation of the integrity of the skin.

• Changes in blood vessels of the skin (hemangiomas, telangiectasias, spider veins).

• Peeling.

• Violation of elasticity and moisture.

• Temperature change.

• Changes in the skin (spot, papule, vesicle, scale, erosion, ulcer, scar).

• Changes in skin appendages (damage to nails, hair).

• The presence of edema and its prevalence (on the face, eyelids, extremities, general edema - anasarca - or local).

• The child's skin color is determined by the relative content of melanin, oxyhemoglobin, reduced hemoglobin, and carotene, the thickness of the stratum corneum, and the degree of blood supply.

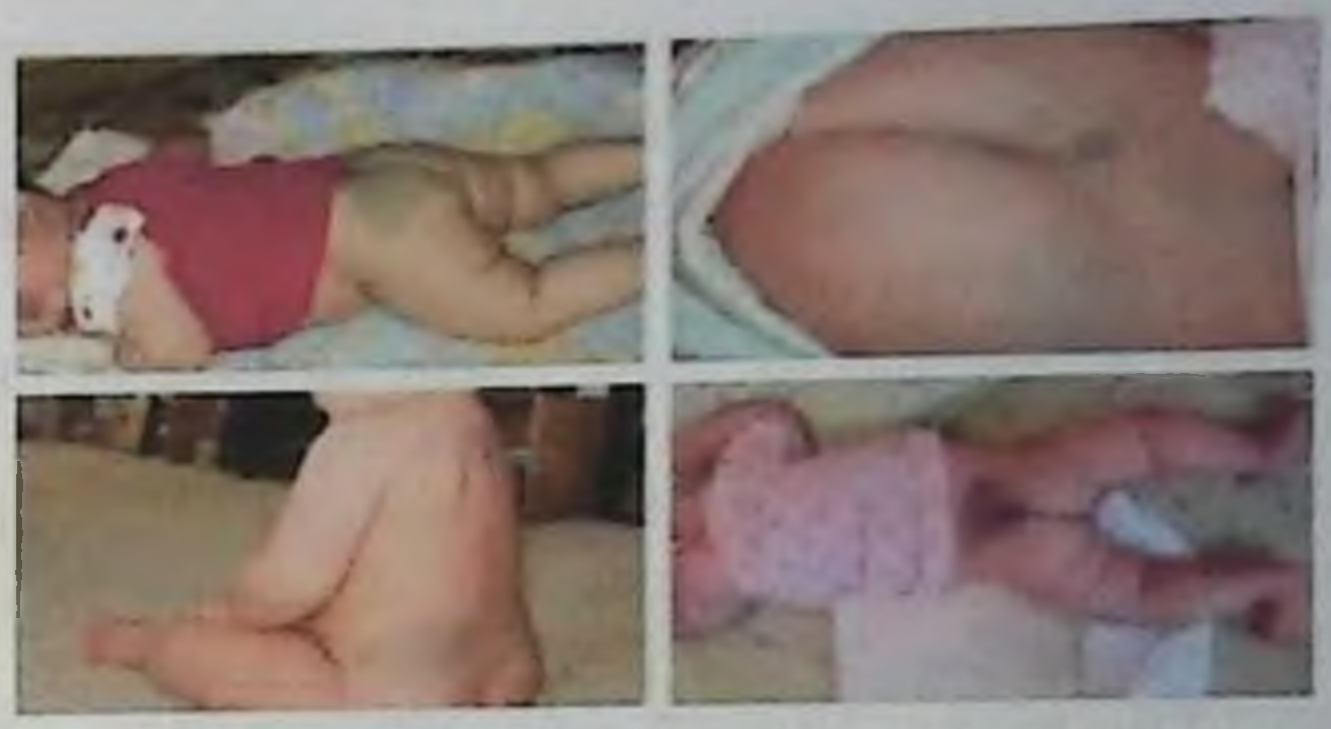
Semiotics of pigmentation. Violations in the melanocyte system are divided into hyper melanosis (increase in melanin in the epidermis or dermis) and hypomelanosis (decrease in the content or absence of melanin in the dermis, leukoderma), which in turn can be generalized or localized.

Hyperpigmentation of healthy skin is observed in chronic renal failure, and primary biliary cirrhosis.

With chronic nutritional deficiency (kwashiorkor, nephrotic syndrome, malabsorption syndrome, etc.), hyperpigmented spots appear on the skin of the trunk. With pellagra, the pigmentation zone is limited to areas of the skin exposed to light or trauma; vitamin B12 deficiency is accompanied by premature graying of the hair and hyper melanosis, especially pronounced around the small joints of the hands.

Freckles (ephelides) are small pigment spots located at the level of the skin on the face on both sides of the nose, and on the shoulders. Larger coffee-au-lait spots may be a manifestation of Recklinghausen's neurofibromatosis.

Blue nevus - a group of pigment cells accumulated in the dermis; the epidermis translucent above them looks like bluish spots, when localized in the region of the sacrum they are called Mongolian spots, they disappear after the age of 3 years (Rice 2)



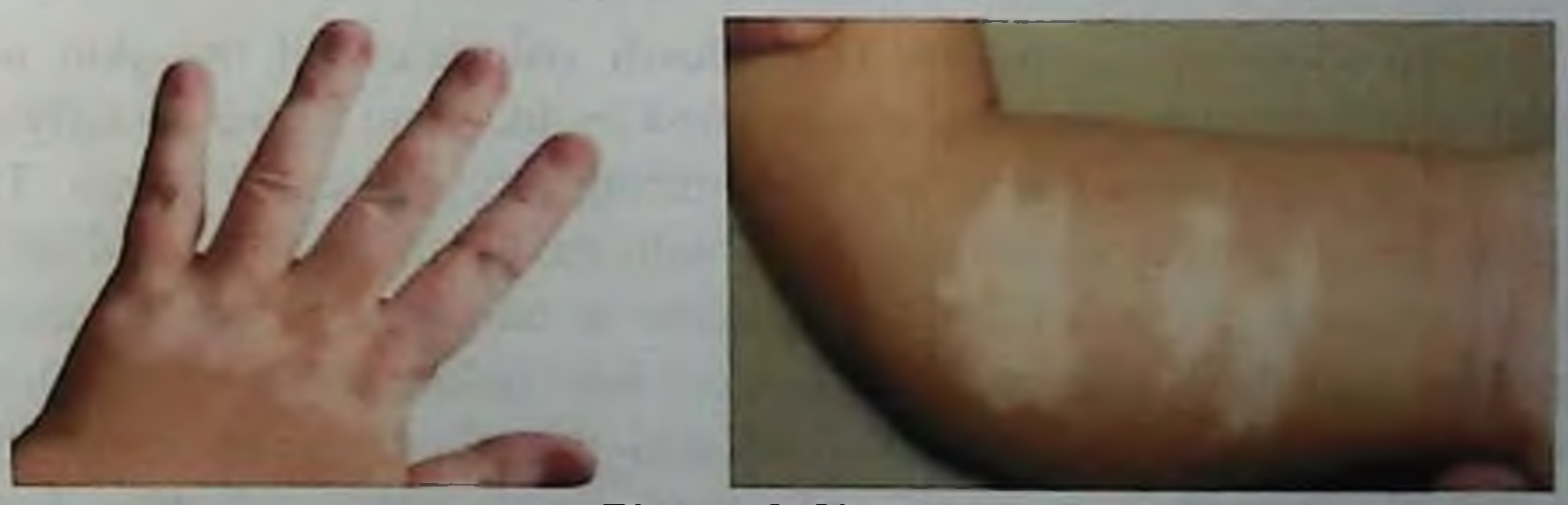
Picture 2 Mongolian spots in children.

In children, there are also benign and malignant variants of melanoma (tumor-like, growing pigmented nevus).

Mastocytosis, or urticaria pigmentosa, is a disease characterized by paroxysmal rashes of spots, papules, and pink-red blisters of a round or oval shape, localized on the trunk, limbs, scalp, face, and rarely on the palms and soles.

Hypomelanoses are observed in albinism, and Germansky-Goodluck syndrome.

Vitiligo (acquired pigment defect) occurs at any age and is characterized by depigmented spots of various shapes and sizes with clear boundaries, localized on the skin of the face (around the eyes and in the mouth), in the genital area, hands, and feet, elbow and knee joints, the upper half of the chest (Rice 3). Skin elements may spontaneously disappear, new spots may appear, or the depigmentation is progressive.



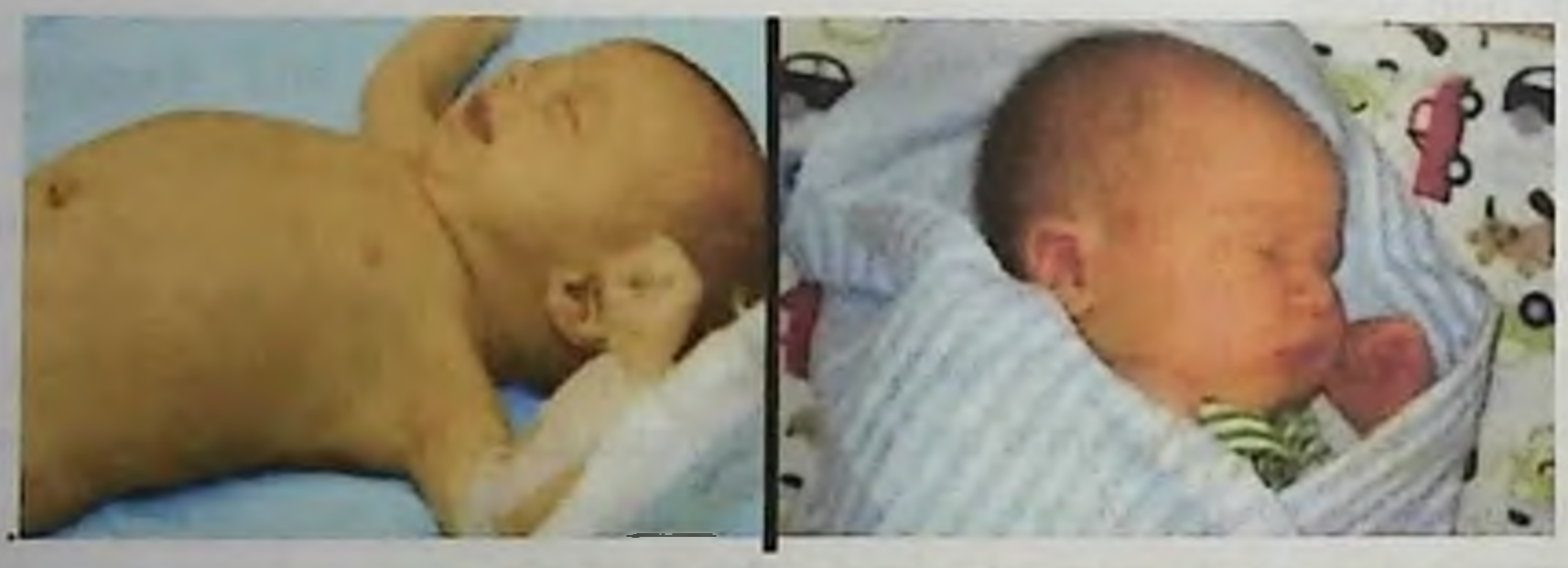
Picture 3. Vitiligo

Paleness of the skin. The pallor of the skin due to anemia, insufficiency of peripheral blood supply, edema (due to a decrease in blood circulation in the periphery (centralization of blood circulation) or

a decrease in cardiac output (acute left ventricular failure in diphtheria, pneumonia, endo myocarditis, pericarditis, aortic stenosis, etc.).

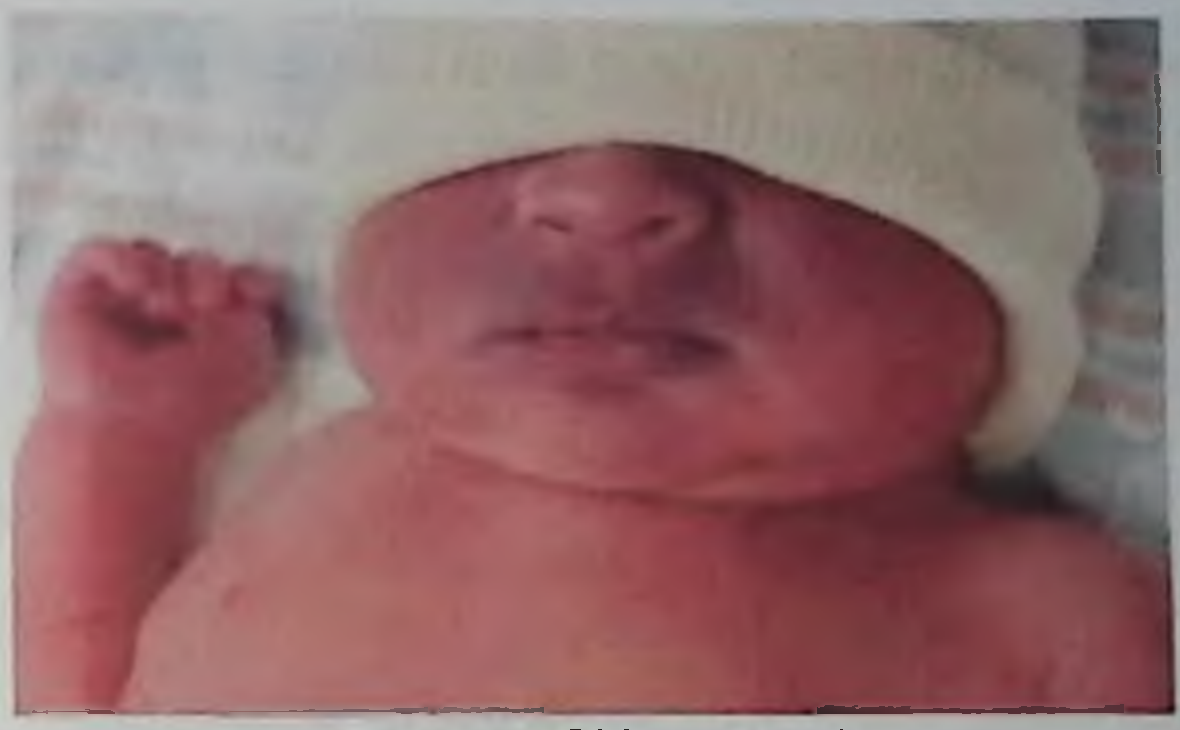
The immediate causes of pale skin can be glomerulonephritis, collapse, shock, fear, cold, pain, etc.

Icteric discoloration of the skin. Icteric staining of the skin and sclera is observed with hemolytic anemia (lemon-yellow tint), and mechanical jaundice (greenish); in the initial stages of the disease, when bilirubin begins to accumulate in the skin, it acquires an orange tint. First of all, yellowness with true jaundice appears on the sclera, the lower surface of the tongue, and soft palate (Rice 4). With false jaundice (due to the use of carrots, tangerines, tomatoes, etc.), only the skin is stained - carotene jaundice occurs, while the level of bilirubin in the blood is normal (intensely yellow coloration with an overdose of carotene is observed on skin areas with a thicker epidermis (on the palms and soles); the sclera of the eyes, where the epithelium layer is very thin, remain white



Picture 4. Jaundice of the skin

Skin cyanosis. Cyanosis is a bluish coloration of the skin and mucous membranes, which is determined by the state of the underlying network of capillaries and is detected during physical examination. The clinical severity of cyanosis correlates with the presence of more than 50 g/l of reduced (oxygenated) hemoglobin in capillary blood. Cyanosis appears when the oxyhemoglobin content falls below 85%. There is total and regional cyanosis (perioral - around the mouth, cyanosis of the nasolabial triangle, cyanosis of the distal parts of the body (acrocyanosis) - the tip of the nose, earlobes, lips, tip of the tongue, hands, feet) (***Picture*** 5).



Picture 5. Skin cyanosis

Skin hyperemia. Redness of the skin as a physiological phenomenon can occur under the influence of high and low temperatures, with mental arousal, increased physical activity, and mechanical irritation of the skin, which is temporary and is usually limited to one or more areas of the body. Pathological hyperemia appears with erythrocytosis, diseases accompanied by fever, when exposed to atropine, alcohol poisoning, scopolamine or hallucinogens, with severe acetonemia, Kawasaki syndrome (mucocutaneous lymphatic syndrome with the periodic appearance of polymorphic erythema along with erythema on the palms and soles), syndrome harlequin in newborns, with feta-fetal transfusion in identical twins.

Vascular formations of the skin. Hemangiomas: superficial and deep, regressing and progressive.

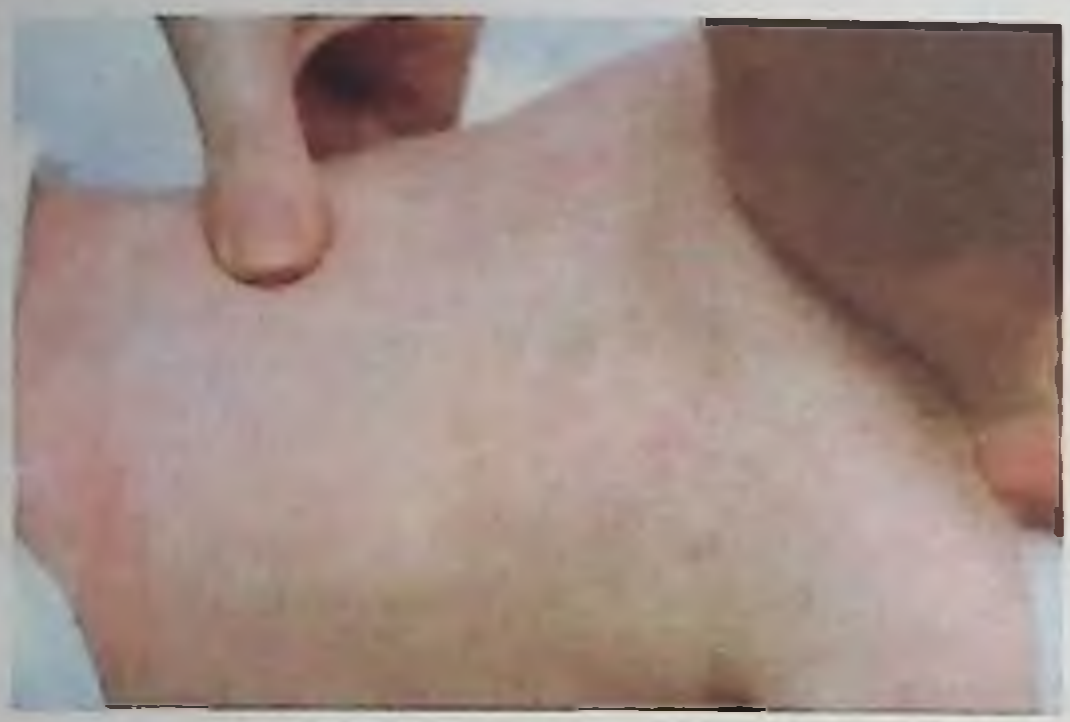
Semiotics of rashes (exanthema). Rash elements. The primary elements are classified as roseola, macula, papule, nodule, blister, vesicle, blister, and hemorrhage.

Secondary morphological elements include pigmentation and depigmentation, scale, crust, erosion, crack, abrasion, ulcer, scar, cicatricial atrophy, lichenification, and vegetation.

Roseola (roseola) - a speck of pale pink, red color ranging in size from 1 to 5 mm. The shape is rounded or irregular, the edges are clear or blurry, it does not protrude above the level of the skin, and it disappears when the skin is pressed and stretched.

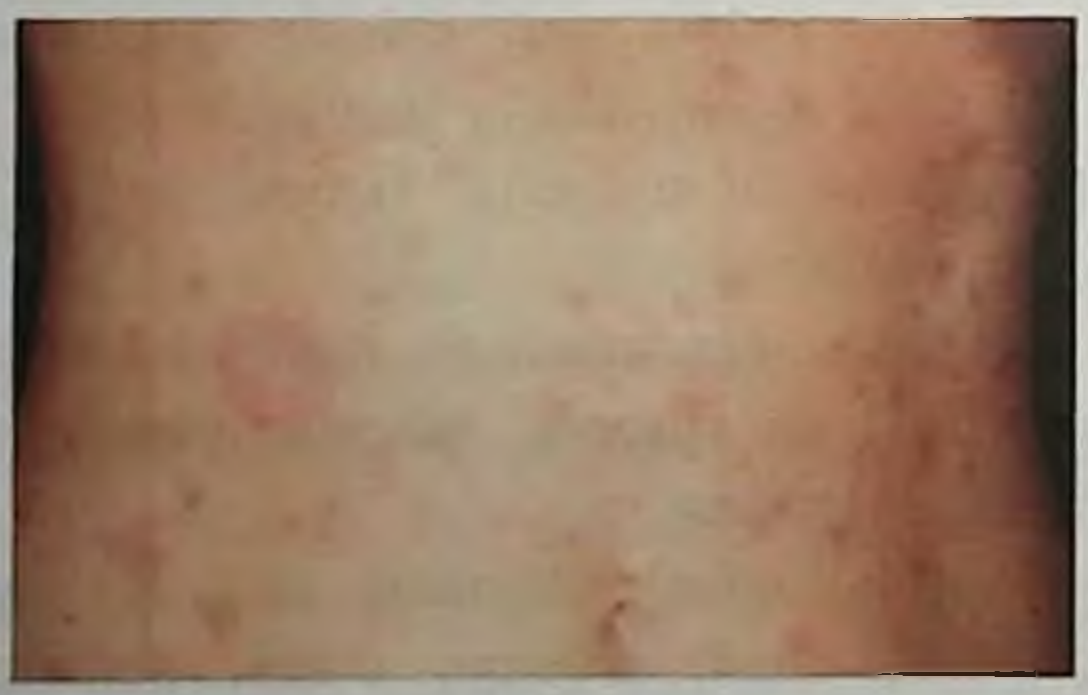
Roseola is found in many infectious diseases, especially typical of typhoid fever. Multiple roseolas 1-2 mm in size are usually described as

a small punctate rash (with scarlet fever), in the process of resolution they become covered with scales or disappear without a trace. (Rice 6).



Picture 6. Spotted rash

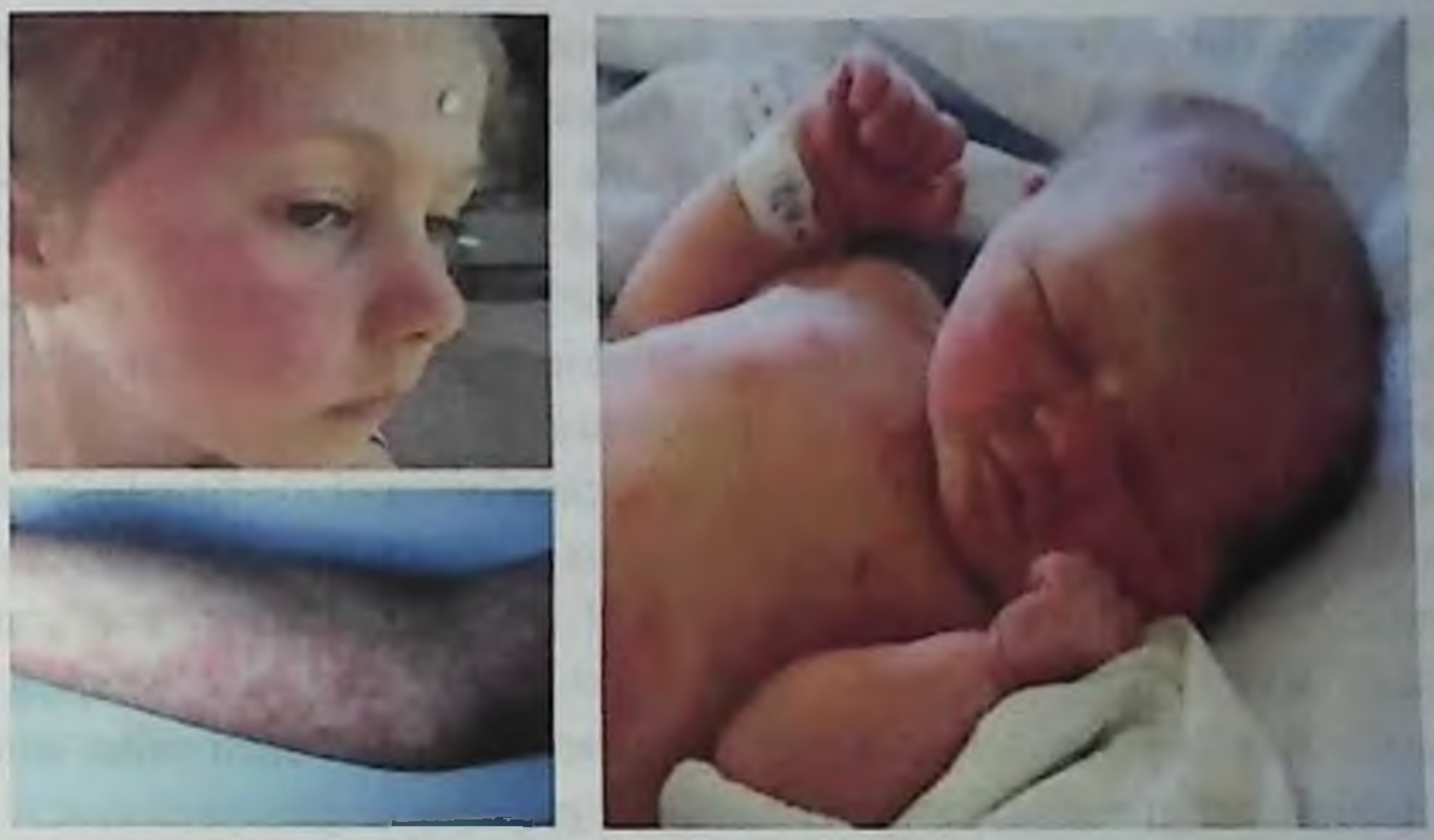
The spot (macula) has the same color as roseola, size - from 5 to 20 mm, and does not protrude above the skin level. The form is often incorrect. The spot disappears with pressure on the skin and reappears after the cessation of pressure (Rice 6). Multiple spots ranging in size from 5 to 10 mm are described as a small-spotted rash (for example, with rubella). Spots 10-20 mm in size form a large-spotted rash (for example, with measles, or allergies).



Picture 7. Papule

Erythema (erythema) - extensive areas of hyperemic skin of red, purple-red, or purple color. It occurs as a result of the fusion of large spots formed by vasodilation not only of the papillary layer of the skin but also of the sub-papillary vascular plexus. Spots larger than 20 mm tending to coalesce should be considered erythema (*Rice.7*).

Erythema is most typical of erysipelas, thermal and ultraviolet burns.



Picture 8. Erythema in children

Hemorrhagia (haemorrhagia) - hemorrhage into the skin as a result of the destruction of skin vessels. It looks like dots or spots of various sizes and shapes do not disappear when the skin is stretched. The color is initially red, purple, or violet, then, as the hemorrhage resolves, it becomes yellow-green and, finally, yellow (the formation of hemosiderin during the breakdown of red blood cells). Color changes are clearly visible in larger hemorrhages.

Pinpoint hemorrhages are called petechiae (petechia). Multiple rounded hemorrhages ranging in size from 2 to 5 mm are described as purpura. Irregular hemorrhages larger than 5 mm are called ecchymosis.

Hemorrhages can be superimposed on other elements of the rash. In such cases, they talk about the petechial transformation of roseola, spots, and papules. As a rule, this is observed in the severe course of the disease. Hemorrhagic rashes are detected with typhus (often in combination with roseola - roseola-petechial rash), another rickettsiosis, hemorrhagic fevers, and sepsis. Hemorrhagic elements of irregular shape on a dense basis (star-shaped rash) are characteristic of meningococcemia, and pneumococcal sepsis.

Ecchymoses with a diameter of more than 10 mm subsequently undergo necrosis. Small hemorrhages can also have a non-infectious origin (capillary toxicosis, toxic-allergic vasculitis, beriberi C, etc.).

Hemorrhages arranged linearly, in the form of strips, are called vibices. Bruises are called simulations, larger bruises are called suffusions.

Papula (papula) - an element of the rash, rising above the level of the skin, has a flat or domed surface, and the size is from 1 to 20 mm. The shape and color are the same as those of roseola and spots. Papules often leave behind pigmentation and flaking of the skin. Depending on the shape and size of the papules, they are military, the size of a millet grain, more often conical in shape and located around the hair follicle; in the center of such an element, a horn plug or hair is noticeable. Lenticular papules are about the size of a lentil or a pea and can be raised, oval, round, flat, and multifaceted. Nummular, coin-shaped, are papules that have arisen as a result of merging with each other during the peripheral growth of large flat-shaped papules.

Papules that have merged with each other form plaques, and when the latter merge, areas appear that are located on large areas of the skin, the size of a palm or more. Often, during a routine clinical examination of a child, it is very difficult or even completely impossible to distinguish roseola from papules. On the other hand, the same sick child may have both roseola and papules (typhoid, paratyphoid, infectious mononucleosis), papules, and spots (measles) at the same time. In such cases, it is appropriate to describe the rash as roseolopapular or maculopapular. Thus, the size of papules is simultaneously indicated: roseola-papules have a size of up to 5 mm, and maculo-papules - are from 5 to 20 mm.

A tubercle (tuberculum) is a limited, dense, cavityless formation protruding above the skin surface with a diameter of 1-2 to 5-10 mm. The tubercles are formed as a result of accumulation in the dermis-specific inflammatory infiltrate. Clinically, the tubercle is similar to a papule but differs from it in that when the tubercle is felt, a dense infiltrate in the skin is always clearly defined. In addition, tubercles, unlike papules, undergo necrosis during reverse development, often form ulcers, and leave behind a scar or cicatricial atrophy of the skin. The tubercles are most typical of cutaneous leishmaniasis, leprosy, and tuberculous skin lesions, tertiary and late congenital syphilis.

Knot (nodus) - a cavityless, limited, deep seal deep into the skin, often standing above the level of the skin. The size of the nodes - from a

hazelnut to a chicken egg and more. They are formed as a result of the accumulation of cellular infiltrate in the subcutaneous tissue and in the dermis itself. Nodules of an inflammatory nature have a soft or testy consistency, and fuzzy borders, the skin above them is red, and they are prone to rapid resolution. The nodes that appeared as a result of a specific inflammation (colliquative tuberculosis, syphilitic gum) have a dense texture, are sharply delimited from the surrounding tissues, and are prone to disintegration and ulceration, followed by scarring.

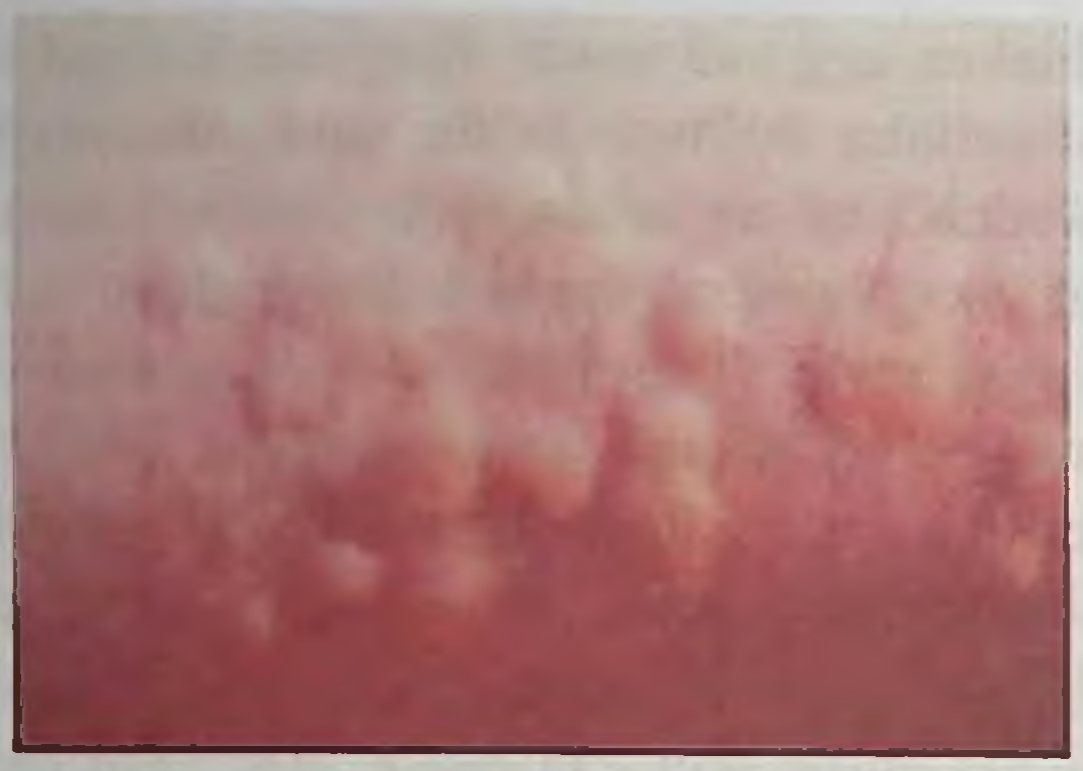
A blister (Urtica) is an acutely inflammatory, asexual element that rises above the level of the skin, ranging in size from 2-3 to 10-15 cm or more, and has a round or oval shape, often accompanied by itching. Color - from white to pale pink or light red. A blister usually forms quickly and quickly disappears without leaving any trace behind. Occurs as a result of limited acute inflammatory edema of the papillary layer of the skin and simultaneous expansion of capillaries. The appearance of urticarial elements is characteristic of allergic reactions of various origins (drug, food, cold allergies), including those of an infectious nature. Sometimes it occurs in the prehistoric period of hepatitis B.

Vesicle - a cavity element ranging in size from 1 to 5 mm, is a detachment of the epidermis. Typically, the blisters are filled with clear, cloudy, or bloody contents and may shrink and form a clear or brown crust.

If the cover of the bubble is opened, then erosion is formed - a wetting surface of pink or red color limited by the size of the bubble. Bubbles do not leave scars on the skin. In the case of accumulation in the bubble of a large number of leukocytes, it turns into an abscess - a pustule (pustular).

Inflammatory changes are noted at the base and around the bubble. Pustules are divided into single-chamber (chickenpox) and multi-chamber (natural smallpox). A group of vesicles located on inflamed skin is called herpes.

Vesicles are characteristic of herpetic and enterovirus infections, chicken pox, smallpox, erysipeloid and foot-and-mouth disease.



Picture 9. Bubbles

Bubble (bulla) - cavity element up to 3-5 cm in diameter, located in the upper layers of the epidermis and under the epidermis.

The contents of the blisters can be serious, bloody, and purulent. They can fall off, forming a crust, open, forming an erosive surface, and turn into unstable pigmentation.

The bubble occurs more often against the background of an erythematous spot, and less often against the background of unchanged skin. Elements can be located both inside the epidermis, in the styloid layer (pemphigus vulgaris), and under the epidermis (polymorphic exudative erythema, dermatosis herpetiformis). It is observed with a bullous form of erysipelas, sometimes with smallpox, and thermal burns.

Secondary morphological elements are formed as a result of the evolution of the primary elements of the rash.

Hyperpigmentation (hyper pigmentation) - a change in skin color as a result of an increase in melanin in it or the deposition of hemosiderin of primary elements.

Depigmentation (depigmentation) occurs as a result of a decrease in the content of melanin in the skin, observed after the disappearance of the nodule, tubercle - the resolution of patchy-scaly (pityriasis versicolor, eczematoid) and papular (psoriasis) elements.

Scale (squama) - an accumulation of torn cells of the stratum corneum, sometimes layers of the epidermis that are subject to it. Scales occur on primary morphological elements - papules (psoriasis, syphilis), tubercles, after the resolution of vesicles (eczema), etc. Depending on the shape and size of the scales, floury (pityriasis scales) are

distinguished, when the skin surface looks sprinkled with flour (xeroderma), and lamellar peeling - horny plates of various sizes, up to parchment-like masses, separated from significant areas of the skin (Leiner's desquamative erythroderma).

Erosion (erosion) is a defect in the skin within the epidermis as a result of the opening of a vesicle, bladder, or abscess, repeating their shape and size. When vesicles and pustules merge, erosions have scalloped edges. Erosions can also occur as a result of maceration of the skin in the area of \u200b\u200bfolds or maceration of other elements of the rash, most often papules. When healing, erosion does not leave a scar, usually there is only temporary pigmentation.

An abrasion (excoriation) is a violation of the integrity of the skin resulting from scratches, scratches, and other injuries.

Abrasions can be superficial - within the epidermis, sometimes involving the papillary dermis, and heal without a scar. Deeper abrasions, involving the deep layers of the dermis, leave a scar behind. Abrasions are characterized by a tendency to infection.

An ulcer (ulcus) is a deep skin defect that reaches the dermis, subcutaneous fat, fascia, muscles, and bones. It arises as a result of the decay of the tissue of the primary element (tubercle, node, ecthyma). Its size is from 1 mm to the size of a coin or palm and more; the shape can be round, oval, linear, oblong, or irregular. The surrounding tissue is either inflamed (edema, hyperemia) or infiltrated. Ulcers always heal with scarring.

Cracks, tears (fissures, rhagades) - linear damage to the skin in the form of its rupture, resulting from excessive dryness due to loss of elasticity due to inflammatory infiltration or overstretching of the skin. Cracks can be located within the epidermis and dermis. Usually, they are localized in the corners of the mouth, interdigital folds, on the palms, soles, over the joints, and in the anus. Superficial crack after healing leaves no traces. After the healing of deep cracks, linear scars remain.

A crust (crustal) is formed on the skin as a result of drying of the detachable weeping surface (blister, bladder, abscess, ulcer, erosion). The crusts can have a different color (with serous exudate transparent with a yellowish tinge; with purulent - yellow, greenish or brown; with

hemorrhagic - brown or black) and shape (layered, oyster-like - syphilitic rupee), impetiginous - similar to drops of dried honey.

Scar (cicatrix) - the formation of connective tissue at the site of a deep defect. Occurs after healing of deep skin defects at the site of ulcerated tubercles, deep pustules, knots, deep burns, and wounds. Scar formation is accompanied by the death of the sebaceous and sweat glands, hair follicles, vessels, and elastic fibers, and the disappearance of the skin pattern. Usually, scars are located below the level of the skin or are at its level, less often rising above the level of the skin - hypertrophic scars (keloid - their variety).

Lichenification (lichenification) - a focus on increased skin pattern, accompanied by its thickening and compaction, hyperpigmentation, and dryness. Lichenification foci are most often localized in the neck, elbow, and popliteal folds, wrist and ankle joints, inguinal folds, and scrotum and occur in chronic dermatosis accompanied by itching (eczema, neurodermatitis).

Vegetation (vegetation) is a papillary thickening of the skin that occurs as a result of the growth of the styloid layer of the epidermis and papillomatosis of the dermis during a long-term inflammatory process. More often it is formed I am in the area of papular elements and ulcers. Vegetations can erode, bleed, and are prone to the addition of a secondary pyococcal infection.

VERIFICATION QUESTIONS

1. All following skin functions are underdeveloped in newborn, EXCEPT:

A. absorption
B. thermoregulation
C. protection
D. secretion

2. What appendage structures of the skin are more developed by birth?

A. sebaceous glands
B. apocrine glands
C. eccrine sweat glands
D. nails

3. Flat, circumscribed area of color change, neither elevated nor depressed with noalteration in skin texture:

A. macula
B. papule
C. plaque
D. wheal

4. Small solid elevation of the skin, less than 1 cm in diameter

A. papule
B. tumor
C. vesicle
D. bulla

5. Flat-topped, palpable lesions of variable size and configuration that represent dermal collections of edema fluid in upper dermis:

A. wheal
B. vesicle
C. bulla
D. papule

6. The skin normally uses ultraviolet light to synthesize which vitamin?

A. D3
B. B_6
C. C
D. A

7. A 4-day-old newborn milia (small, white raised lesions over the nose, chin, and forehead). Milia are an example of which type of primary lesion?

A. Papule
B. patch
C. vesicule
D. pustule

The physician informs parents that their newborn has physiologic jaundice. How long does this disorder usually last?

B. 1 week
C. 24 hours
D. 2 to 3 days
E. 3 weeks

9. What change skin color associated with liver disease:

F. Jaundice
G. Erythema
H. Cyanosis
I. Hyperpigmentation
10. What change skin color associated with anemia:
A. Pallor
B. Jaundice
C. Erythema
D. Cyanosis

2. ANATOMICAL AND PHYSIOLOGICAL FEATURES OF THE MUSCULOSKELETAL SYSTEM

By the time the baby is born, the process of ossification is not fully completed.

Diaphyses of tubular bones are represented by bone tissue, and the vast majority of epiphyses, all spongy bones of the hand and part of the tubular bones of the foot consist of cartilaginous tissue.

Ossification points in the epiphyses begin to appear only in the last month of intrauterine development and by birth are outlined in the bodies and arches of the vertebrae, the epiphyses of the femur and tibia, as well as the calcaneus, talus, and cuboid bones.

Ossification points in the epiphyses of other bones appear already after birth during the first 5-15 years, and the sequence of their appearance is quite constant.

The totality of the ossification nuclei present in a child is called "bone age".

After the birth of a child, the bones grow rapidly. The growth of bones in length occurs due to the presence of epiphyseal cartilage. It performs a bone-forming function until the bone reaches its final size (18-25 years). Subsequently, it is replaced by bone tissue and fuses with the epiphysis. Bone growth in thickness occurs due to the periosteum, in the inner layer of which young bone cells form a bone plate (periosteal method of bone tissue formation).

The bone tissue of newborns has a porous coarse fibrous mesh (beam) structure. Bone plates are not numerous, and are located incorrectly. Haversian canals look like randomly scattered cavities. As the child grows, there is a repeated restructuring of the bone with the replacement of the fibrous mesh structure by the age of 3-4 years with a lamellar one, with secondary Haversian structures.

According to the chemical composition, the bone tissue of a child contains more water and organic substances and fewer mineral substances than in adults. With age, the content of hydroxyapatite in the bone (its main mineral component) increases. The fibrous structure and characteristics of the chemical composition determine the greater elasticity of the bones in children and their pliability when compressed. The bones in children are less brittle, but more easily bent and deformed.

The blood supply to the bone tissue in children is more abundant than in adults, due to the number and large branching area of the diaphyseal, and well-developed metaphyseal and epiphyseal arteries.

By the age of 2, the child develops a single system of intraosseous circulation. This creates anatomical prerequisites for the occurrence of hematogenous osteomyelitis in children (up to 2-3 years of age, more often in the epiphyses, and at an older age - in the metaphyses). In children older than 2 years, the number of blood vessels in the bones decreases significantly and increases again only at the time of prepubertal and pubertal growth acceleration.

The periosteum in children is thicker than in adults, as a result of which, in case of injury, subperiosteal fractures of the "green line" type occur. The functional activity of the periosteum in children is significantly higher than in adults, which ensures rapid transverse bone growth.

In the prenatal period and in newborns, all bones are filled with red bone marrow, which contains blood cells and lymphoid elements and performs hematopoietic and protective functions. Only by the age of 12, do the bones of a child in their external structure and histological features approach those of an adult.

Age features of joints in children.

Newborns already have all the anatomical elements of the joints, but the epiphyses of the articulating bones consist of cartilage. The capsules of the joints of the newborn are tightly stretched, and most of the ligaments are characterized by insufficient differentiation of the fibers that form them, which determines their greater extensibility and lower strength than in adults. These features determine the possibility of subluxations, such as the head of the radius and humerus.

The development of the joints most intensively occurs before the age of 3 years and is due to a significant increase in the motor activity of the child. For the period from 3 to 8 years, the amplitude of movements in the joints gradually increases in children, the process of restructuring the fibrous membrane of the articular capsule of the ligaments continues actively, and their strength increases. At the age of 6-10 years, the structure of the joint capsule becomes more complicated, the number of villi and folds of the synovial membrane increases, and the formation of

vascular networks and nerve endings of the synovial membrane occurs. At the age of 9-14 years, the process of restructuring the articular cartilage slows down. The formation of articular surfaces, capsules, and ligaments is generally completed only by 13-16 years of age. Features of individual parts of the skeleton and joints of the child.

Scull.

The skull at the time of birth is represented by a large number of bones connected by wide cartilaginous and connective tissue layers. The sutures between the bones of the arch (sagittal, coronal, occipital) are not formed and begin to close only from the 3-4th month of life. The edges of the bones are even, teeth are formed only in the 3rd year of a child's life. (Rice 9).

The formation of sutures between the bones of the skull ends by 3-5 years of age. Overgrowing of seams begins after 20-30 years.

The most characteristic feature of the skull of a newborn is the presence of fontanelles (not ossified membranous areas of the cranial vault), due to which the skull is very elastic, its shape can change during the passage of the fetal head through the birth canal.

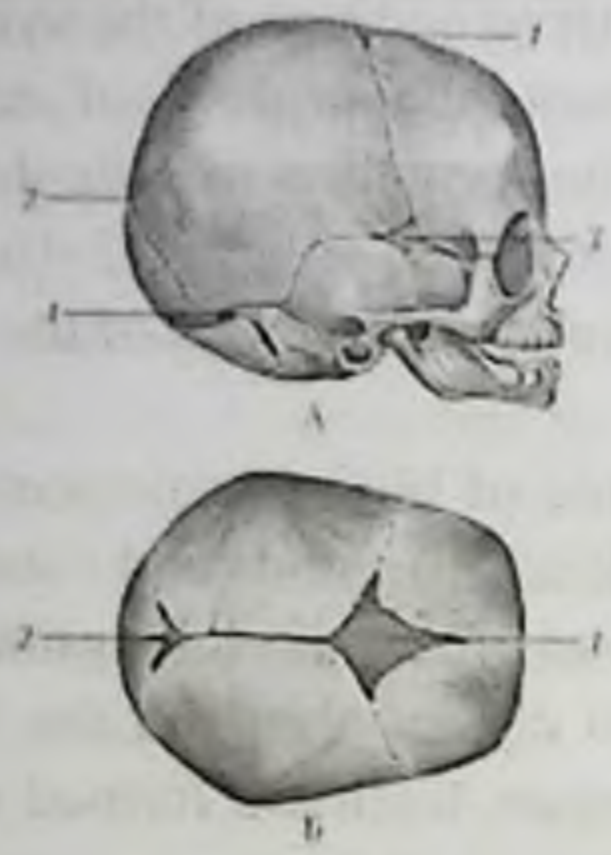
A large fontanelle is located at the intersection of the coronal and sagittal sutures. Its dimensions are from 1.5x2 cm to 3x3 cm when measured between the edges of the bones. The large fontanel usually closes by the age of 1-1.5 years (at present, often already by the 9-10th month of life).

The small fontanel is located between the occipital and parietal bones, by the time of birth it is closed in 3/4 of healthy full-term children, and in the rest, it is closed by the end of the 1-2nd month of life.

Lateral fontanelles (anterior wedge-shaped and posterior mastoid) in full-term babies are closed at birth

The cerebral part of the skull is much larger in volume than the facial one (in a newborn 8 times, and in adults only 2 times).

The eye sockets of a newborn are wide, the frontal bone consists of two halves, the superciliary arches are not expressed, and the frontal sinus is unformed.



Picture 10. The skull of a newborn.

A - side view: 1 - lambdoid seam; 2 - small fontanel; 3 - parietal bone; 4 - large fontanel; 5 - coronal suture; 6 - wedge-shaped fontanel, 7 - large wing of the sphenoid bone; 8 - scaly part of the temporal bone; 9 - mastoid fontanel. B - top view: 1 - small fontanelle; 2 - sagittal suture; 3 - parietal bone; 4-large fontanel; 5 - frontal bone.

The jaws are underdeveloped, and the lower jaw consists of two halves.

The skull grows rapidly for up to 7 years.

In the first year of life, there is a rapid and uniform increase in the size of the skull, the thickness of the bones increases by 3 times, and the structure of the bones of the cranial vault is formed.

At the age of 1 to 3 years, the ossification points merge, and cartilage is gradually replaced by bone. In the 1st-2nd year, halves of the lower jaw grow together, in the 2nd-3rd year, due to the increased function of the masticatory muscles and the completion of the eruption of milk teeth, the growth of the facial skull increases.

From 3 to 7 years, the base of the skull grows most actively, and by the age of 7, its growth in length ends.

At the age of 7-13 years, the skull grows more slowly and evenly.

At this time, the fusion of individual parts of the bones of the skull is completed.

At the age of 13-20, the facial part of the skull grows predominantly, and sexual differences appear. There is a thickening and pneumatization of the bones, which leads to a decrease in their mass.

Spine

The length of the spinal column in a newborn is 40% of the length of his body and doubles in the first 2 years of life.

❖ Different parts of the spinal column grow unevenly, in the first year of life the lumbar part grows most rapidly, and the coccygeal part grows the slowest.

❖ In newborns, the vertebral bodies, as well as transverse and spinous processes are relatively poorly developed, intervertebral discs are relatively thicker than in adults, they are better blood supply.

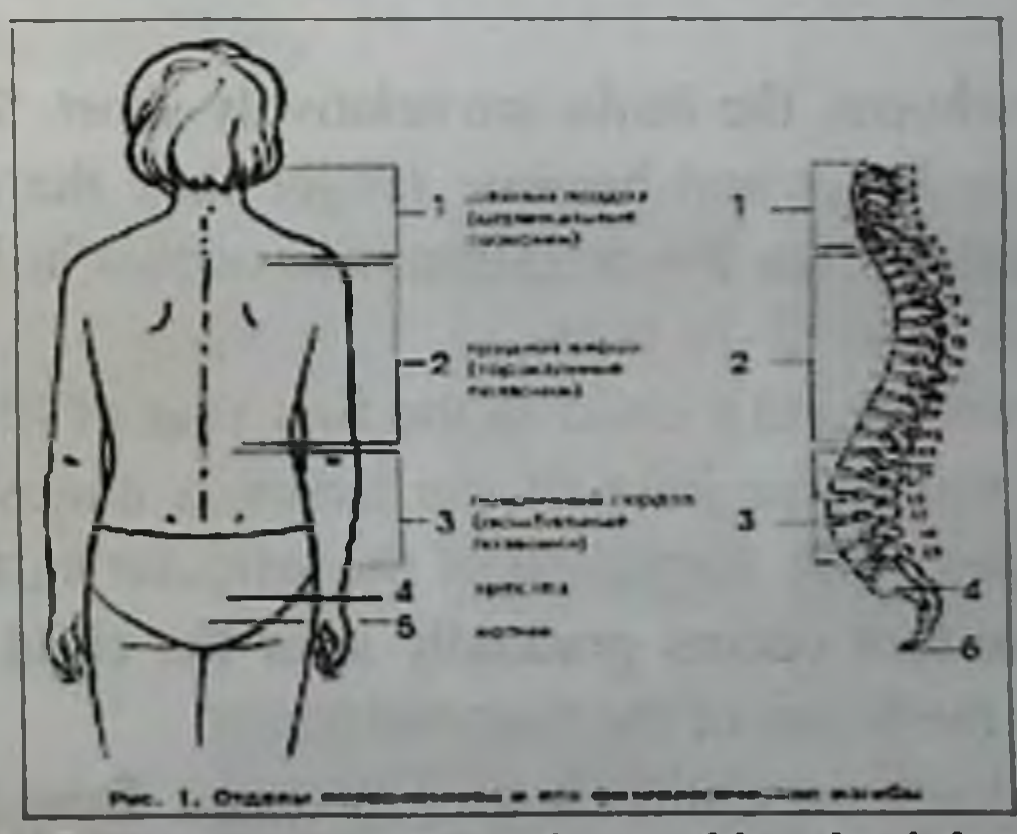
❖ Physiological curves begin to form only starting from 3-4 months.

❖ Cervical lordosis is formed after the child begins to hold his head.

❖ When the child begins to sit (5-6 months) there is a thoracic kyphosis.

❖ Lumbar lordosis begins to form after 6-7 months

when the child begins to sit and intensifies after 9-12 months when the child begins to stand and walk. At the same time, sacral kyphosis is formed (Rice 10).



Picture 11. Departments of the spine and its physiological curves

❖ Bends of the spinal column become clearly visible by 5-6 years.

❖ The final formation of cervical lordosis and thoracic kyphosis is completed by the age of 7, and lumbar lordosis - is by puberty.

❖ Rib cage

❖ The chest of a newborn has a conical shape, its anterior-posterior dimension is larger than the transverse one. The ribs extend from the spine almost at a right angle and are located horizontally. The chest, as it were, is in the position of maximum inspiration.

❖ The ribs in young children are soft, pliable, easily bend, and spring when pressed. The depth of inspiration is provided mainly by excursions of the diaphragm, the place of attachment of which, when breathing becomes difficult, is drawn in, forming a temporary or permanent Harrison's groove.

❖ When the child begins to walk, the sternum descends and the ribs gradually take on an inclined position. By the age of 3, the anteroposterior and transverse dimensions of the chest are compared in size, the angle of inclination of the ribs increases, and costal breathing becomes effective.

❖ By school age, the chest flattens, and depending on the type of physique, one of its three forms begins to form: conical, flat, or cylindrical. By the age of 12, the chest moves into the position of maximum exhalation.

❖ Only by the age of 17-20 does the chest acquire its final shape. Limbs

❖ In newborns, the limbs are relatively short. Subsequently, the lower limbs grow faster and become longer than the upper ones. The highest growth rate of the lower extremities occurs in boys aged 12-15 years, and in girls aged 13-14 years.

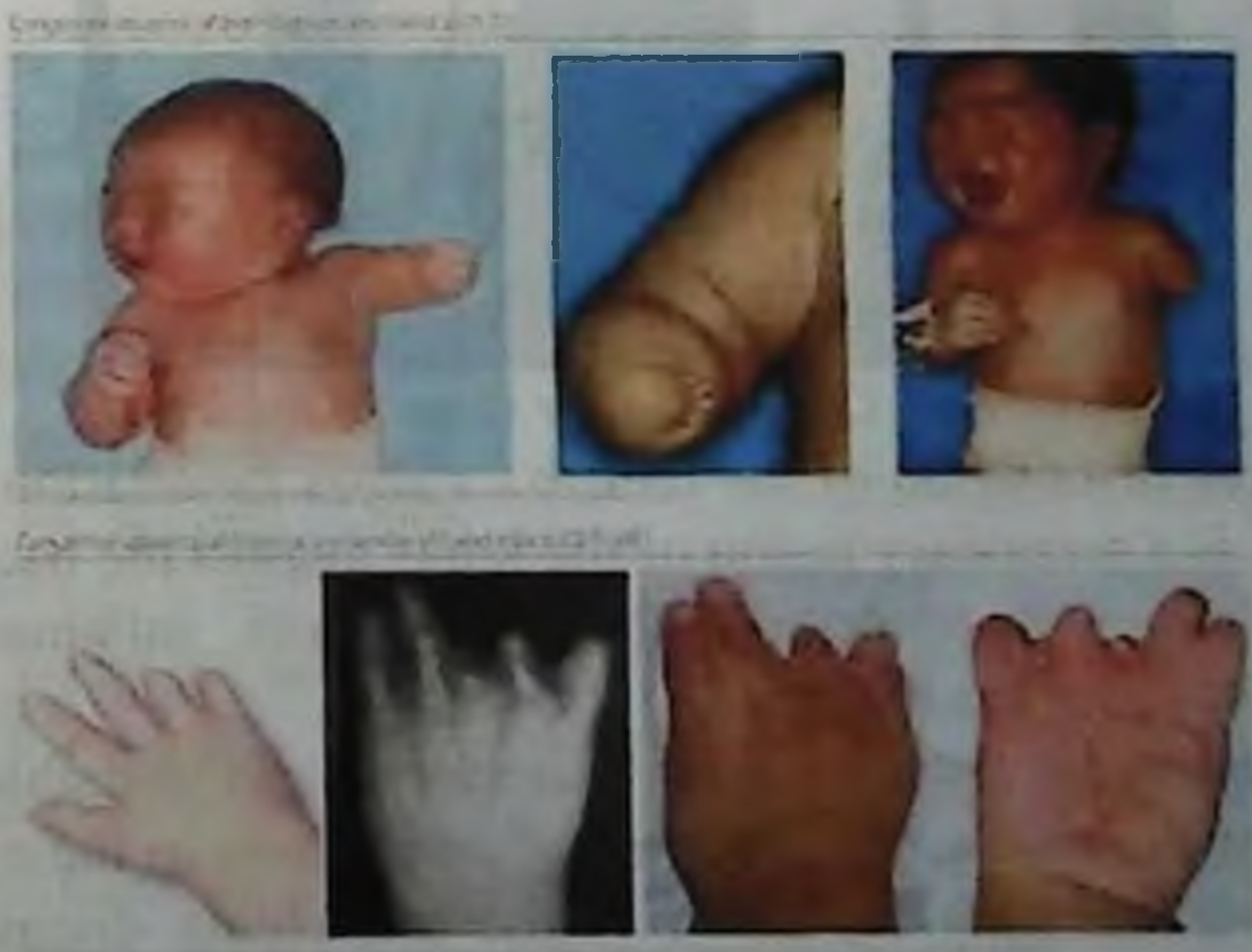
❖ A newborn and a child in the first year of life has a flat foot. The line of the transverse joint of the tarsus is almost straight (in an adult it is S-shaped). The formation of the articular surfaces, ligaments, and arches of the foot occurs gradually after the child begins to stand and walk, and as the bones of the foot ossify.

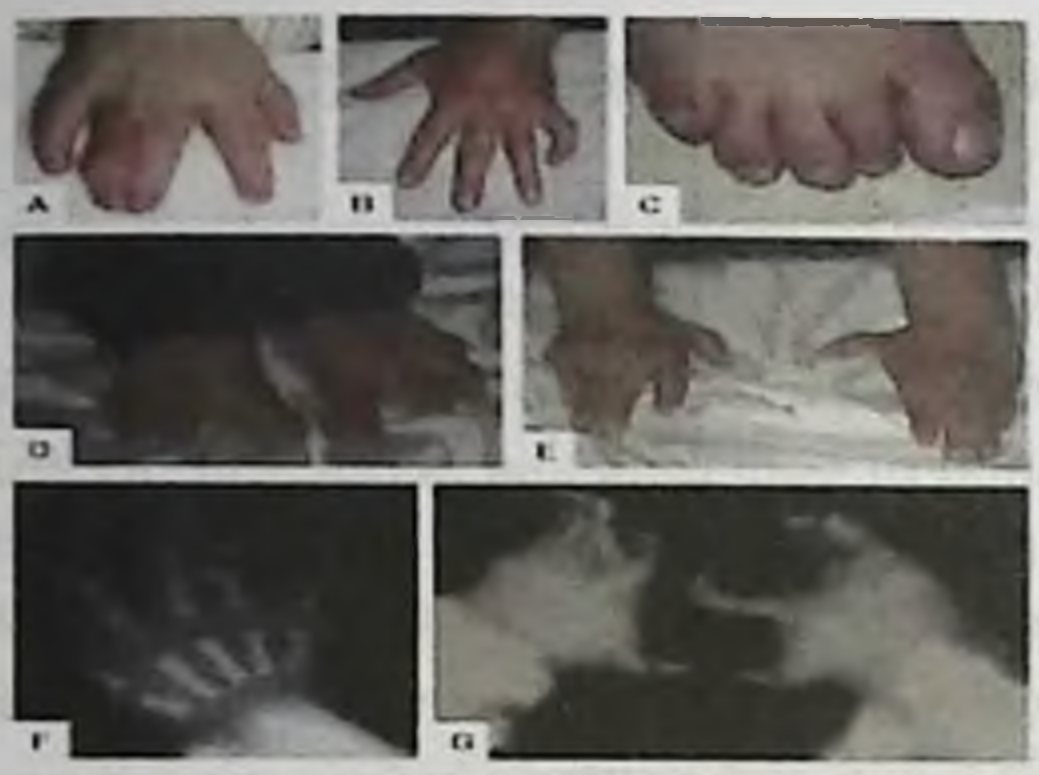
❖ Milk teeth in children usually erupt from the age of 5-7 months. in a certain sequence, while the teeth of the same name on the right and left halves of the jaw appear simultaneously.

❖ The order of eruption of milk teeth is as follows: 2 internal lower and 2 internal upper incisors, and then 2 external upper and 2 external lower incisors (by the year - 8 incisors), at the age of 12-15 months - the anterior molars (molars), at 18- 20 months - canines, at 22-

24 months - back molars. Thus, by the age of 2, a child has 20 milk teeth.

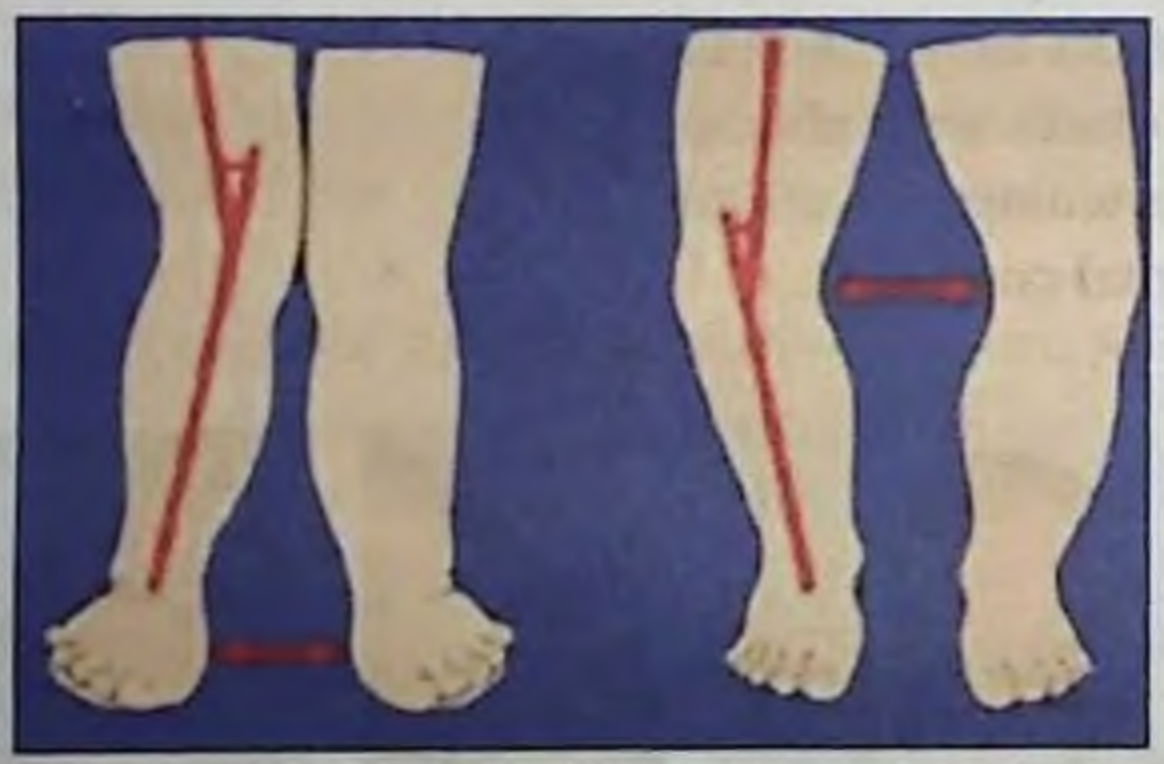
- ❖ The period of replacement of milk teeth with permanent teeth is called the period of mixed dentition.
- ❖ A permanent tooth erupts usually 3-4 months after the loss of milk. The formation of both milk and permanent occlusion in children is a criterion for the biological maturation of the child (dental age).
- ❖ Semiotics of lesions of the osteoarticular system (Rice 11).
- ❖ Anomalies in the development of the skeleton.
- ❖ Pain in bones and joints.
- ❖ Deformation of bones and joints
- ❖ Hypermobility
- ❖ Arthritis.
- ❖ Violation of ossification processes.
- ❖ Imperfect osteogenesis.
- ❖ Osteomyelitis and periostitis.
- ❖ Tumors of the skeletal system.
- ❖ Fractures and subluxations.
- ❖ Shortening of the limbs.
- ❖ Dental pathology.





Picture 12. Malformations of the skeleton

Semiotics of arthralgia. Pain in the affected joint (arthralgia) occurs as a result of irritation of nerve endings in its various structures, excluding articular cartilage, which does not have nerve endings and blood vessels. Polyarthralgia refers to the presence of pain in 5 or more joints (Rice 12).

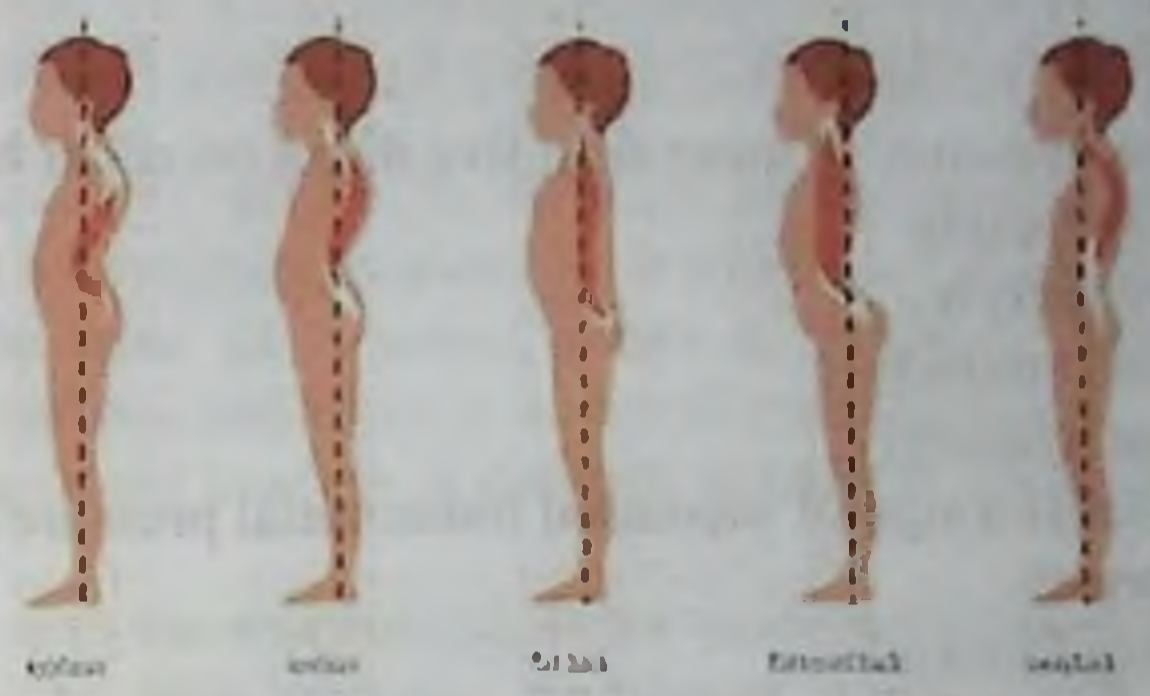


Picture 13. Changes in the shape of the legs:

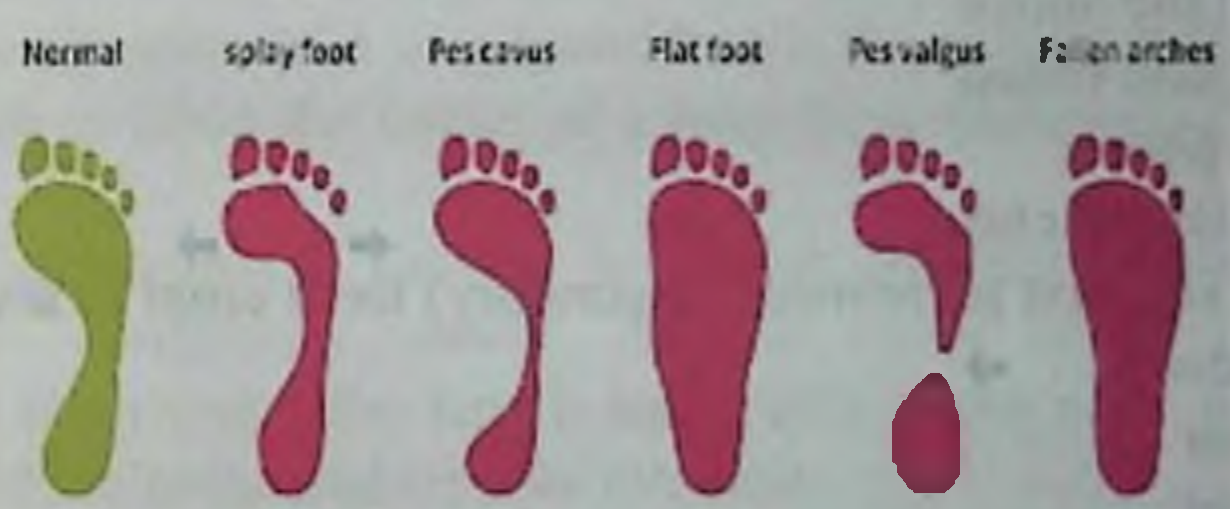
a - varus installation of the foot; b - valgus installation of the foot

Arthropathy is a secondary lesion of the joints against the background of various pathological processes. It can be both inflammatory and degenerative-dystrophic in nature.

The common distinguishing features of arthropathies are the asymmetry of the lesion, the presence of parallelism in the clinic of the articular syndrome with the clinic of the underlying disease, positive dynamics during the treatment of the underlying process, the scarcity of the x-ray picture (no usuration, narrowing of the joint space, signs of ankylosis).



Picture 14. Changes in the shape of the back



Picture 15. Changes in the shape of the foot

VERIFICATION QUESTIONS

1. When is the anterior fontanel closed normally?

A. between 12 and 18 months of age
B. by the first month
C. by the second month
D. between 6 and 8 months of age

2. When are the first primary teeth erupted?

A. 6-7 month
B. 10-12 month
C. 14-18 month
D. 2 years

3. How many teeth has 2-year-old child normally?

A. 20
B. 28

C. 24
D. 12
4. The presence of more than five digits on either hand or foot
A. Polydactyly
B. Syndactyly
C. Arachnodactyly
D. Brachydactyly
5. What is a sign of increased intracranial pressure?
A. all above
B. bulging fontanel
C. tense fontanel
D. widened fontanel
6. What deformities of the chest is a sign of rickets?
A. All the above
B. Pigeon breast
C. Kyphosis
D. Barrel chest
7. The first permanent (secondary) teeth erupt at about:
A.6 year
B.4year
C.3year
D.8 year
8. What is a sign of dehydration?
A. depressed fontanel
B. tense fontanel
C. pulsation fontanel
D. flat fontanel
9. What is a sign of ankylosis?
A. limitation range of motion
B. tenderness
C. redness
D. swelling
10. A wasting of tissues, organs, or the entire body; e.g., the wasting of muscles dueto disuse of a fractured limb:
A. Atrophy
B.Spasm
C.Hypertrophy
D. Distony

3. ANATOMICAL AND PHYSIOLOGICAL FEATURES OF THE RESPIRATORY ORGANS IN CHILDREN

The respiratory organs in children are relatively smaller and are characterized by incomplete anatomical and histological development.

❖ The nose of a young child is relatively small, the nasal passages are narrow, and there is no lower nasal passage.

❖ The nasal mucosa is delicate, relatively dry, and rich in blood vessels.

❖ Due to the narrowness of the nasal passages and the abundant blood supply to their mucous membrane, even slight inflammation causes difficulty in breathing through the nose in young children.

❖ Breathing through the mouth in children during the first half of life is impossible since a large tongue pushes the epiglottis backward.

Particularly narrow in young children is the exit from the nose - the choana, which is often the cause of a long-term violation of their nasal breathing.

❖ The paranasal sinuses in young children are very poorly developed or completely absent. As the facial bones (upper jaw) increase and teeth erupt, the length and width of the nasal passages and the volume of the paranasal sinuses increase.

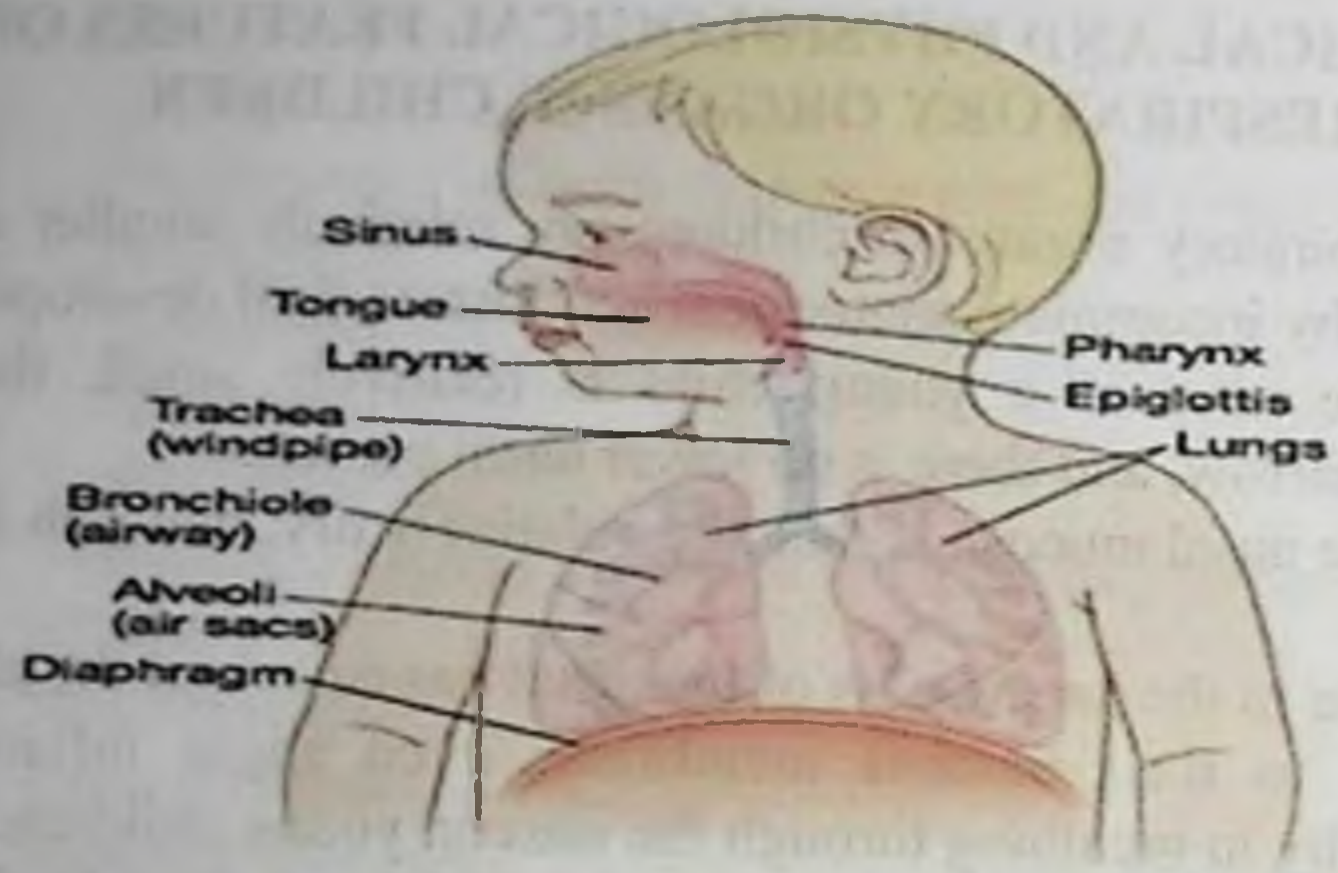
❖ By the age of 2, the frontal sinus appears, and the maxillary cavity increases in volume.

❖ By the age of 4, the lower nasal passage appears.

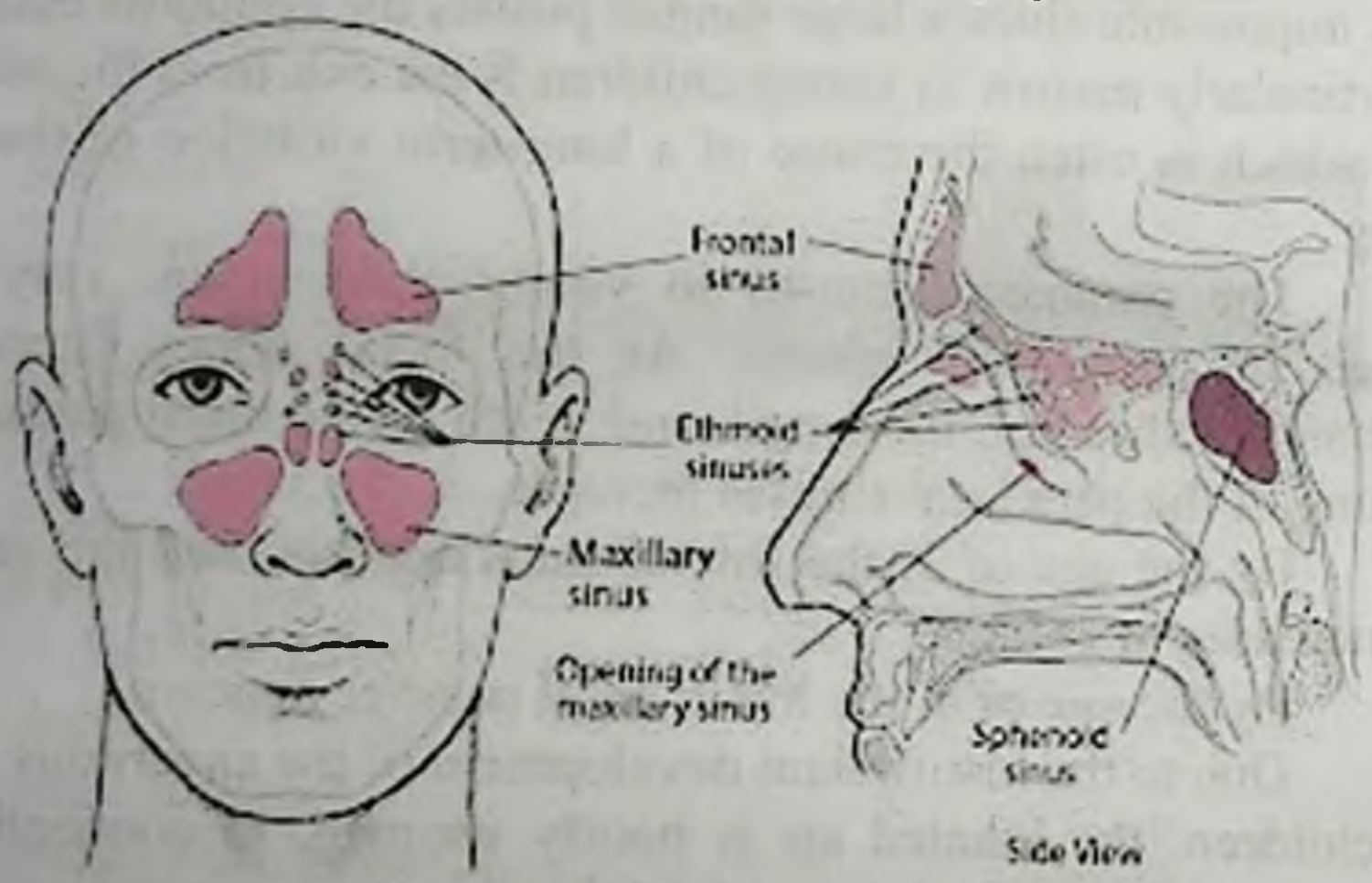
❖ Due to the insufficient development of the cavernous tissue in young children, the inhaled air is poorly warmed, in connection with this, children cannot be taken out into the street at temperatures below - 10 ° C.

❖ Cavernous tissue develops well by the age of 8-9, this explains the relative rarity of nosebleeds in children in the 1st year of life.

❖ A wide nasolacrimal duct with underdeveloped valves contributes to the transition of inflammation from the nose to the mucous membrane of the eyes.



Picture 16. Anatomy of respiratory system



Picture 17. Paranasal sinuses

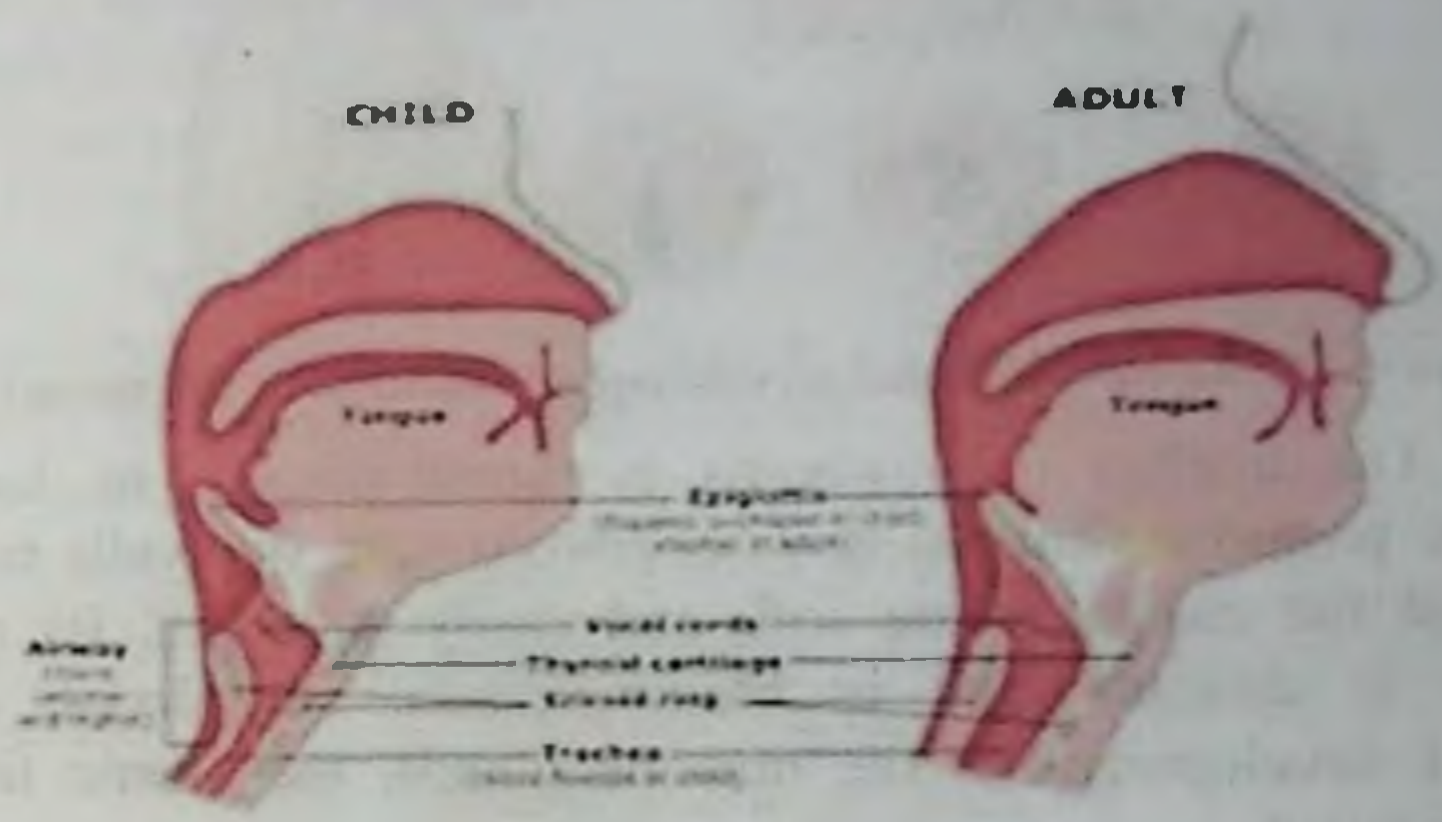
0.5-1 l of mucus per day is secreted into the nasal cavity. Every 10 min

a new layer of mucus passes through the nasopharynx, which contains

bactericidal substances (lysozyme, complement, etc.), secretory immunoglobulin A.

- The pharynx in children is relatively narrow and more vertical than in adults.
- Lymphopharyngeal ring in newborns is poorly developed.

The pharyngeal tonsils become visible only by the end of the 1st year of life. Therefore, sore throats in children under 1-year-old are less common than in older children. By the age of 4-10 years, the tonsils are already well developed, and hypertrophy can easily occur. In puberty, the tonsils begin to undergo reverse development.



Picture 18. **Anatomical and physiological features of the pharynx**

❖ The Eustachian tubes in young children are wide, and the horizontal position of the child's pathological process from

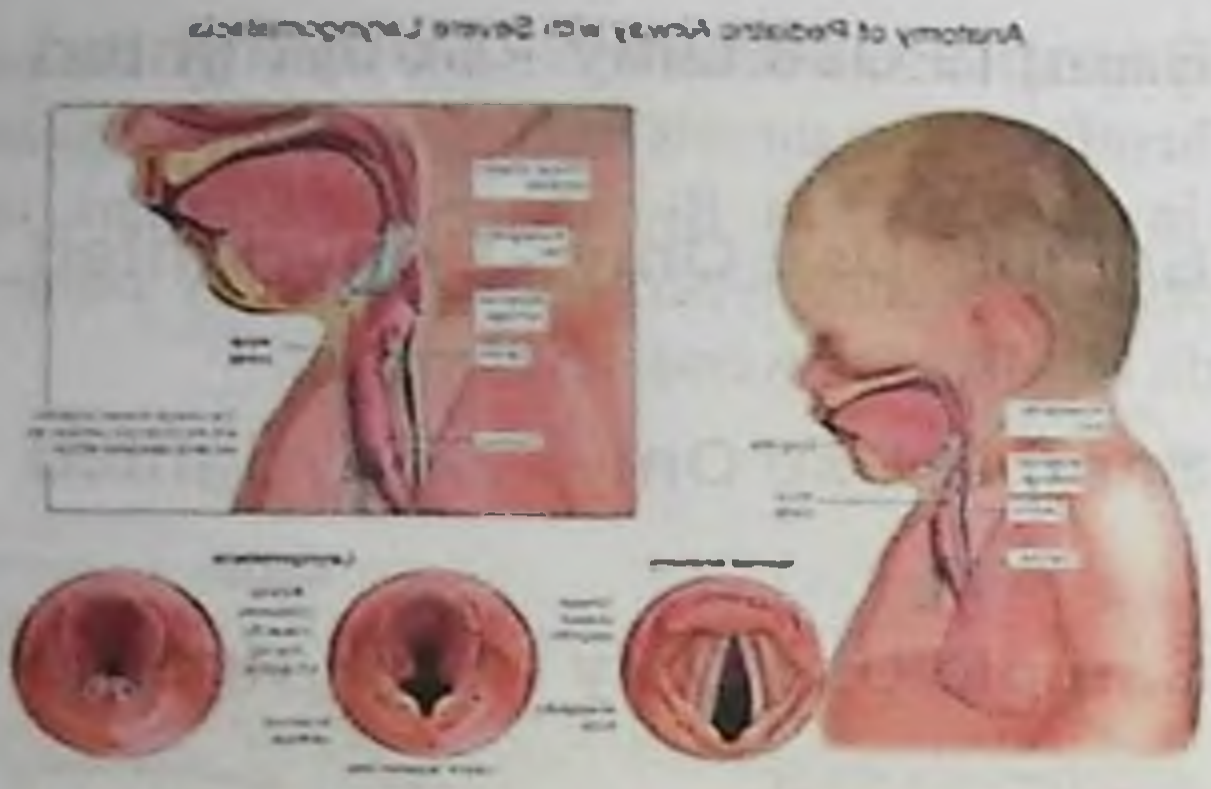
nasopharynx easily spreads to the middle ear, causing the development of otitis media.

❖ The larynx in young children has a funnel-shaped

shape (later - cylindrical) and is located slightly higher than in adults (at the level of the 4th cervical vertebra in a child and the 6th cervical vertebra in an adult). The larynx is relatively longer and narrower than in adults, and its cartilages are very pliable.

❖ False vocal cords and mucous membranes are delicate, rich in blood and lymphatic vessels, and elastic tissue is poorly developed. The glottis in children is narrow.

❖ Vocal cords in young children are shorter than in older children, so they have a high voice. From the age of 12, the vocal cords in boys become longer than in girls.



Picture 17. **Anatomical and physiological features of the larynx**

❖ The trachea in newborns is funnel-shaped, its lumen is narrow, the posterior wall has a wider fibrous part, the walls are more pliable, and the cartilages are soft, and easily squeezed. Its mucous membrane is delicate, rich in blood vessels, and dryish due to insufficient development of the mucous glands, the elastic tissue is poorly developed.

❖ The growth of the trachea occurs in parallel with the growth of the trunk, most intensively - in the 1st year of life and the puberty period.

❖ Features of the structure of the trachea in children lead to inflammatory processes to the easy occurrence of stenotic phenomena determine frequently isolated (tracheitis), combined with damage to the larynx (laryngotracheitis) or bronchi (tracheobronchitis) lesions.

❖ In addition, due to the mobility of the trachea, it may be displaced during a unilateral process (exudate, tumor).

❖ The bronchi are fairly well formed by birth.

❖ Bronchial growth is intense in the 1st year of life and puberty.

❖ Their mucous membrane is richly vascularized and covered with a layer of mucus.

❖ The right bronchus is like a continuation of the trachea, it is shorter and wider than the left.

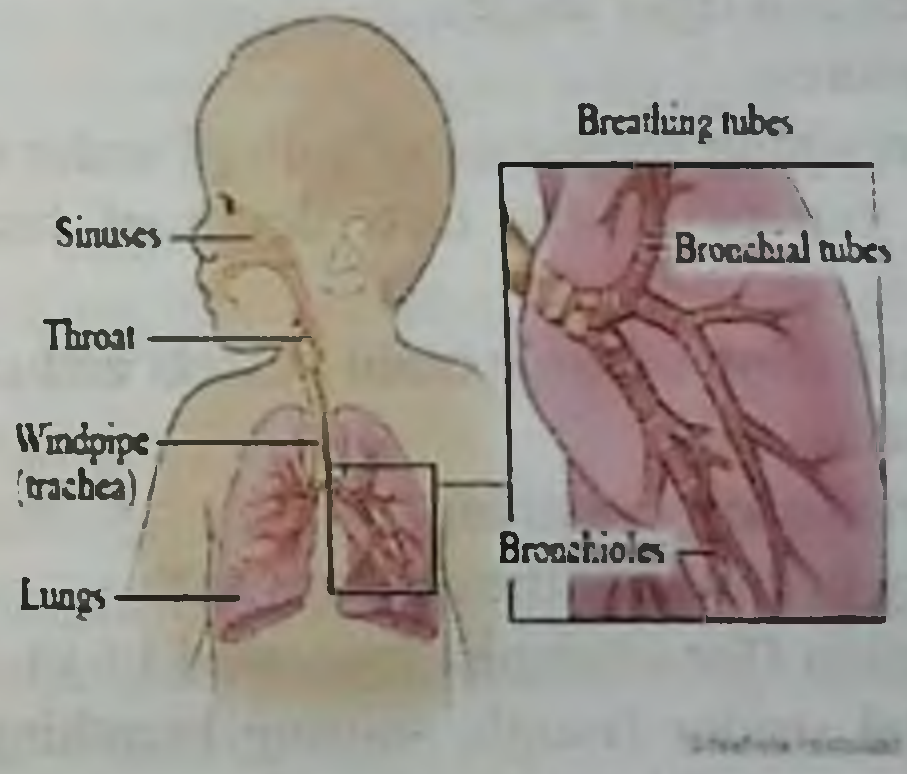
❖ The tenderness of the mucous membrane of the bronchi, and the narrowness of their lumen explain the frequent occurrence in young children of bronchiolitis with a syndrome of complete or partial obstruction.

❖ Lungs in newborns weigh about 50 g, by 6 months their mass doubles, by the year it triples, by 12 years it increases 10 times, by 20 years - 20 times.

❖ Pulmonary fissures are poorly expressed. The acini are not well differentiated.

❖ In the process of postnatal development, alveolar passages with typical alveoli are formed. Their number increases rapidly during the 1st year and continues to increase for up to 8 years. This leads to an increase in the respiratory surface.

❖ The number of alveoli in newborns (24 million) is 10-12 times, and their diameter (0.05 mm) is 3-4 times less than in adults (0.2-0.25 mm). The amount of blood flowing through the lungs per unit of time is greater in children than in adults, which creates the most favorable conditions for gas exchange in them.



Picture 18. Bronchial tubes

Anatomical features:

• The expiratory structure of the chest (horizontal arrangement of the ribs.

• The pleural cavity in infancy is easily extensible due to the weak fixation of the parietal sheets, hence the greater mobility of the mediastinum.

• Softness of the ribs and compliance of the chest

• Softness of the cartilage of the larynx, trachea, and bronchi.

• Rich vascularization of the lungs, highly developed lymphatic system, and more developed interlobular connective tissue.

• Less development of elastic tissue in the lungs and bronchial walls

• Relatively low surfactant activity.

• Weakness of the respiratory muscles.

• "Extensibility" of the lungs is 1/3 of this value in adults, due to a large number of collagen fibers and less extensibility of elastic fibers.

• Diaphragmatic (abdominal) type of breathing, the diaphragm is located high, and its contraction are weak.

• Great excitability of the respiratory center during hypoxia. Relatively weak cardiac sphincter of the stomach.

• The respiratory equivalent in an infant is 2 times higher adult.

• The bronchial tree is formed. In young children, the angle of departure of both bronchi is the same (in adults, the left bronchus departs from the trachea at a right angle).

Physiological features:

• The dynamic breathing resistance of a child under one-year-old is 5 times greater than that of adults. Less depth of breathing. Rapid blockage of the airways.

• Possibility of inflection of large main vessels and compression of the lung during mediastinal shift.

• Tendency to paradoxical breathing.

• Greater tendency to constrict the airways with external compression (for example, increased l / y). There may be symptoms of congenital stridor (rough, snoring breathing) for up to 2 years.

• Reduced diffuse ability; increased tendency to edema and generalization of infection in the lungs. Less depth of breathing.

• Great tendency to atelectasis, and emphysema.

• Tendency to atelectasis.

• Rapid exhaustion of the respiratory muscles. Less depth of breathing.

• A relatively large amount of work (amount of energy) is expended on breathing.

• An overcrowded stomach and flatulence of the intestines reduce the respiratory volume. Less depth of breathing.

• Tendency to periodic breathing.

• Tendency to regurgitation and subsequent aspiration.

• Rapid development of respiratory failure.
• Foreign bodies are found in both bronchi.
• Increased metabolism in children causes a high need for oxygen, meanwhile, the characteristics of the lungs and chest largely limit the depth of breathing, therefore, the intensity of gas exchange is provided by an increase in respiratory rate.

The respiratory rate is greater, the younger the child:
• Premature baby - 40-60 per minute.
• Newborn baby - 30-40 per minute
• From a year to 3 years - 30-35 per minute.
• 5-6 years - 25 per minute.
• 10 years - 18-20 per minute
• Adults - 15-16 per minute.

Breathing rhythm in newborns and children under 1 year unstable, so it is necessary to consider the black hole strictly for 1 minute.

The type of breathing changes with age:
• Up to a year - abdominal (diaphragmatic).
• 1-7 years - mixed.
• From the age of 7 - in boys - abdominal; in girls - chest.

RR/HR ratio:
• In newborns - 1: 2.5
• In children of other ages - 1: 3.5-4
• In adults - 1:4

When the lungs are affected, breathing quickens to a greater extent, and the pulse to a lesser extent.

Semiotics of respiratory diseases
• Forced position.
• Cyanosis.
• Defeat of fingers in the form of "drum sticks".
• Cough.
• Tonsillitis.
• Change in rhythm, and type of breathing.
• Shortness of breath.
• Change in percussion sound, voice trembling, auscultatory picture.
• Wheezing.
• Crepitus.
• Rubbing noise of the pleura.

Pain in the chest. Pain in the chest wall can be classified as follows:

- constant pain;
- Pain not dependent on breathing;
- Pain that occurs only when breathing;
- Constant pain, aggravated by breathing.

Pain during movements not related to breathing is caused by damage to the vertebrae, ribs, and muscles. If such pain also occurs during breathing, coughing, sneezing, or laughter, then in addition to this pathology, one should think about damage to the pleura.

Semiotics of cough.

Cough - a sharp expulsion of air from the lungs and respiratory tract, which before this is delayed by a closed glottis.

Pharyngeal cough. The accumulation of mucus at the entrance to the larynx or dryness of the mucous membrane of the pharynx causes short, usually repeated coughing shocks. They are called coughing, which emphasizes their light nature.

Coughing may be caused by acute or chronic pharyngitis, a mild form of bronchitis, a fixed habit (like a tic) formed during or after bronchitis and sinusitis.

Picture 19. Cough

Simple wet cough - medium-loud cough,arising from irritation of the bronchial mucosa with bronchitis, sinusitis, bronchiectasis (often there is also a persistent cough resembling whooping cough; in the morning, sputum leaves a "full mouth"), with congestive bronchitis

(heart failure), esophageal-tracheal fistula in newborns. In the presence of such a fistula, the child begins to cough immediately after the first sip of food and coughs at each feeding. Cyanosis and severe dyspnea may develop. A distinctive feature of a wet cough is its cyclicity, which is as if the natural cessation of a coughing fit.

Simple dry cough - a cough of almost constant tone without sputum discharge. Usually, such a cough is called irritating, as it is subjectively felt as intrusive and unpleasant. Occurs in the initial stage of bronchitis, with laryngitis, laryngotracheitis, spontaneous pneumothorax, aspiration of a foreign body (immediately after aspiration, cyanosis, and suffocation develop, followed by a persistent, sometimes paroxysmal cough resembling whooping cough), with lesions of the hilar lymph nodes with tuberculosis or non-Hodgkin's lymphomas, with inflammation of the costal pleura (cough occurs with every deep breath). When moving from a cold to a warm room, coughing can occur in healthy children.

Cough with croup - persistent cough of a special tone and overtone. The laryngeal cough has a hoarse overtone,

typical of diseases of the larynx. With diphtheria of the larynx, the cough gradually becomes almost silent. With viral croup (influenza, measles, parainfluenza, etc.) or other diseases, the cough is hoarse and barking, while the voice is preserved.

Bitonic cough - deep cough with double sound:

a high whistling tone and a lower hoarse tone during the coughing jolt. It is characteristic for the narrowing of the lower respiratory tract in the presence of a foreign body or with compression by enlarged paratracheal lymph nodes, and goiter, as well as for other sensing processes in the posterior mediastinum, laryngotracheobronchitis, bronchiolitis.

Paroxysmal cough - sudden onset of a series of coughing shocks. The most striking example is whooping cough. The disease is accompanied by a series of 8-10 short coughing shocks, which are repeated after a reprise - a deep whistling breath (a sound phenomenon associated with the flow of air through a spasmodic glottis). During an attack, pressure in the vessels of the head rises, hypoxia develops, the face becomes red or cyanotic, and the eyes fill with tears. At the end of

the attack, viscous mucus leaves, and there may be vomiting. Such attacks are very debilitating for the child. The severity of coughing fits is individual. The cough is worse and more frequent at night than during the day. There may be a sore on the frenulum of the tongue (cough injury). In the blood, leukocytosis with lymphocytosis is detected. Typical changes on the radiograph are focal streaky shadows in the paracardial region.

The whooping cough is just as obsessive and acyclic but is not accompanied by reprisals. It usually indicates the presence of very viscous sputum. The same cough is observed in cystic fibrosis; its pulmonary manifestations are chronic bronchitis, peribronchitis, and sometimes bronchiectasis with sputum production, often abundant. In the study of sweat, the chloride content is more than 70 mmol / l. In severe purulent bronchitis, sputum is detected, and there are no reprises. In bronchiectasis based on chronic bronchitis, chronic pneumonia, with a cystic lung or individual pulmonary cysts (not associated with cystic fibrosis), there are also no reprises, in contrast to whooping cough. Whooping cough differs from wet cough in the absence of cyclicity.

Psychogenic cough. Cough in a child, especially recurrent, may have a typical genesis. Increased maternal anxiety, concentration, and attention to respiratory symptoms may be the cause of the cough reflex in the child. These children have a series of dry, loud coughs in situations where they want to get attention or achieve their goals; at reception, they cough before the examination, abruptly ceasing to cough after the anxious expectation of trouble associated with the examination is replaced by calm. A new attack of coughing can be provoked by touching on a topic that is unpleasant for the child (whims, observance of the daily routine) or even simply by starting an abstract conversation, as if not paying attention to the child.

Hemoptysis - coughing up sputum with blood in the form of streaks and pinpoint inclusions due to diapedesis of erythrocytes with increased permeability of the walls of blood vessels or rupture of capillaries. Pulmonary bleeding - coughing up pure, scarlet, foamy blood in an amount of 5-50 ml or more. Coughing up blood and bloody sputum is rare in children. The blood secreted when coughing with sputum may be scarlet or altered if there has been a breakdown of red blood cells and

hemosiderin has formed ("rusty sputum" in patients with lobar pneumonia). Unlike bleeding from the stomach, hemoptysis mixes blood with air. Bloody vomit is usually black or brown-black.

Semiotics of the rhythm of breathing.

Assessment of the state of breathing begins with determining its frequency and rhythm, taking into account the age of the child. The respiratory rate (RR) is best calculated in a sleeping child, although this is not always possible. In the waking state, the frequency rate is usually higher, so it is important to know the normal range.

Eupnea is calm normal breathing.

Dyspnea - difficult, strained breathing with shortness of breath, sometimes with cyanosis.

Orthopnea - shortness of breath, in which the child sits, leaning on his hands (forced sitting position with emphasis on his hands). This position is taken by patients with a severe attack of asthma or pulmonary edema to facilitate the work of the respiratory muscles.

Olipnea - enhanced respiratory movements that provide a large amount of inspiration.

Oligopnea - weakening of respiratory movements, accompanied by a decrease in the volume of inspiration.

Tachypnea is fast breathing.

Bradypnea is rare slow breathing. It is typical for stenosis of the respiratory tract caused by croup, aspiration of foreign bodies, compression of the trachea by a tumor or goiter, uremia, diabetic coma (Kussmaul breathing), for severe acidosis of various natures.

Apnea - stopping breathing.

Hyperpnea - increased amplitude of breathing at a normal frequency. It is visible on the chest excursion. Deep breathing is characteristic of severe anemia, metabolic acidosis (for example, salicylates poisoning, an overdose of the carbonic anhydrase inhibitor - diacarb), and respiratory alkalosis.

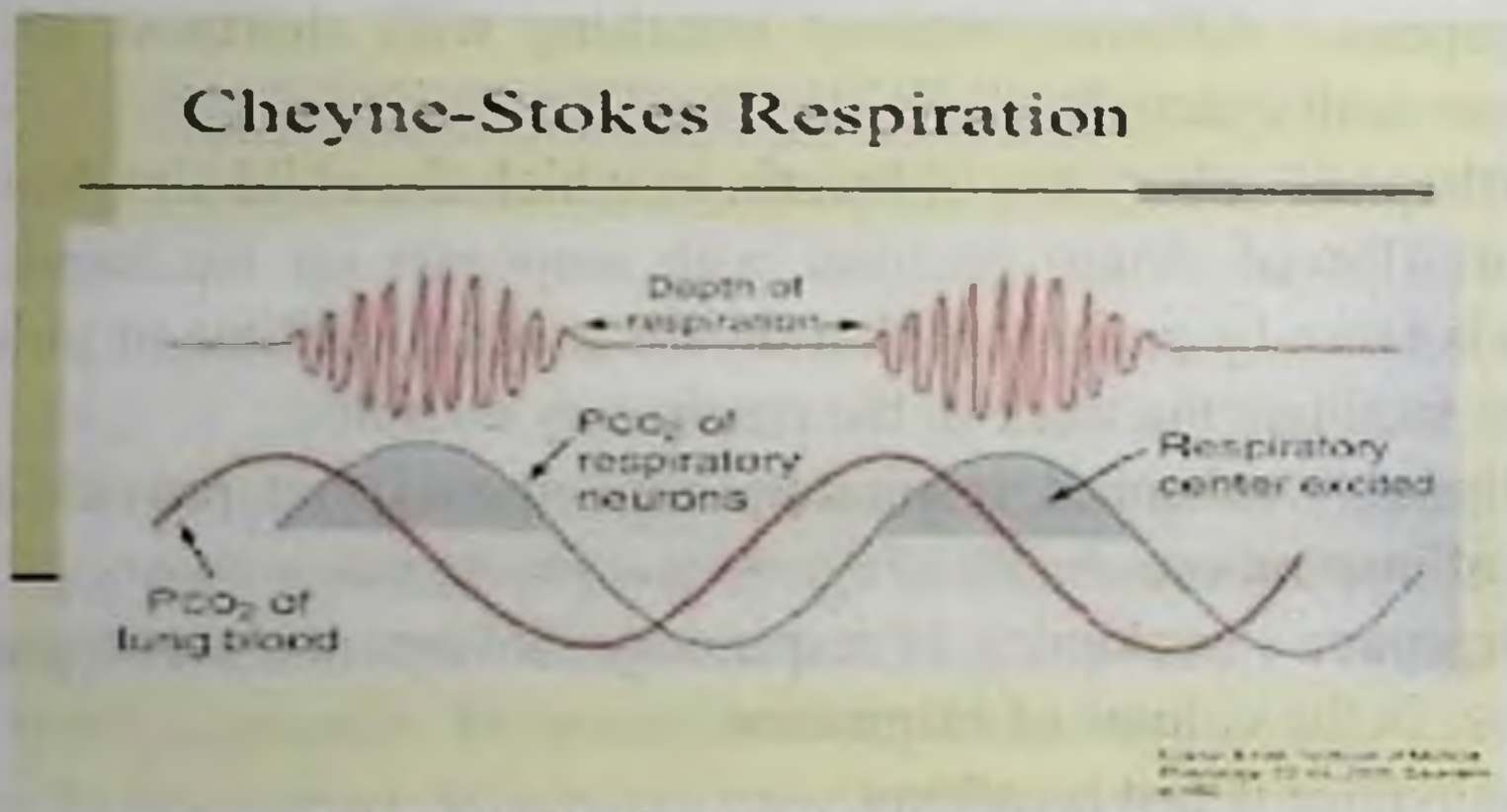
Hypopnea - reduced amplitude of breathing at a normal rate.

Respiratory rhythm disturbances: Periodic breathing - periods of apnea lasting up to 15 seconds (in premature babies, respiratory distress syndrome).

Irregular breathing - changing amplitude and frequency of breathing (with pain, increased intracranial pressure).

Breathing rhythm disorders include pathological types of breathing:

1. Cheyne-Stokes respiration - the respiratory cycles gradually increase, and upon reaching the maximum depth of respiration for a given period, a gradual decrease in its dominant depth and a transition to a pause occur, during the pause the patient may lose consciousness. It is observed in circulatory disorders, cerebral hemorrhages, meningitis, brain tumors, severe intoxications caused by chemical poisoning, etc.

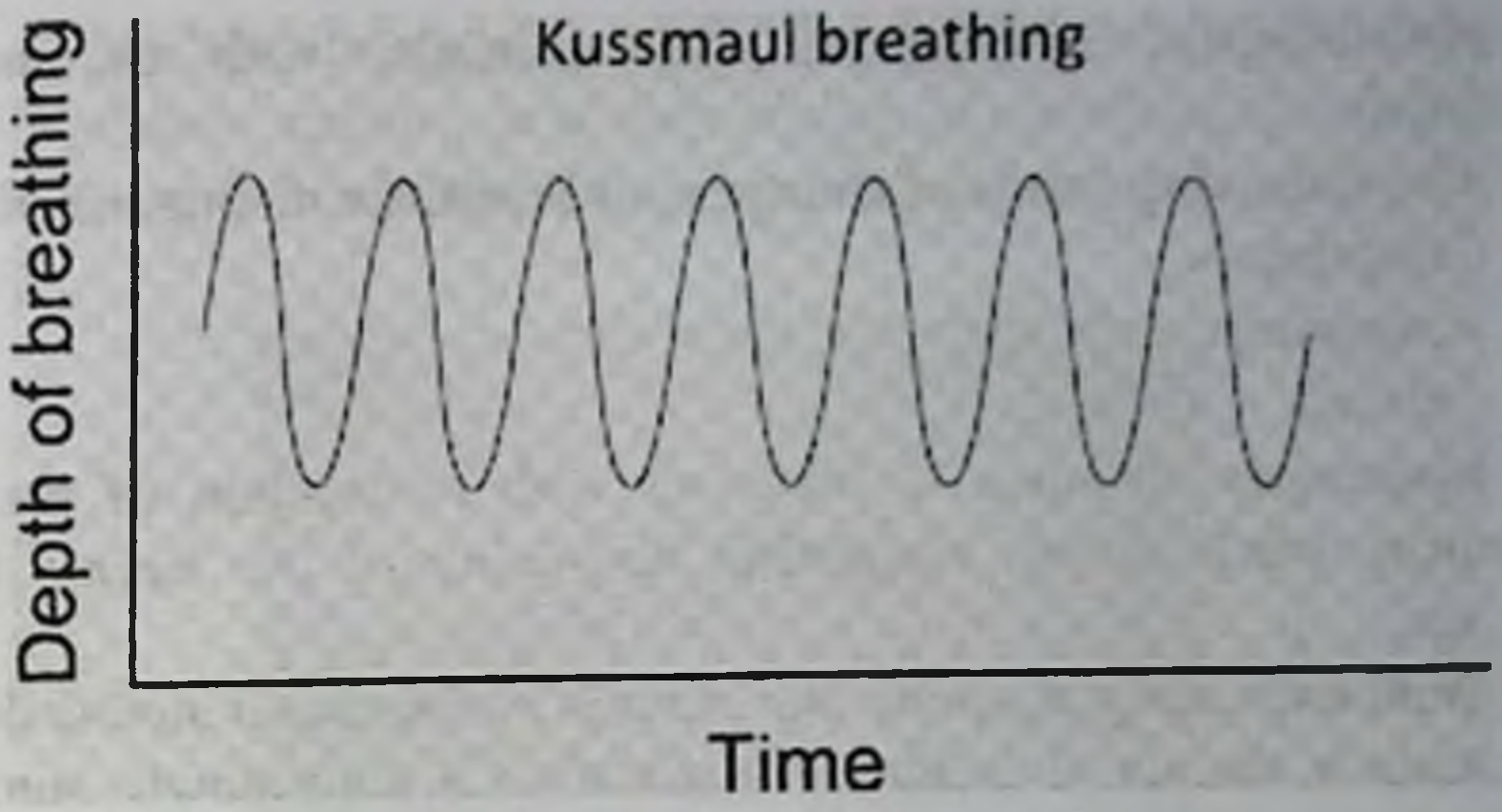


Picture 20. Cheyne-Stokes breathing

2. Biot's breathing - the alternation of uniform respiratory movements and long pauses, there is no strict regularity in the number of breaths and the duration of pauses. It is observed in brain tumors, meningitis, meningoencephalitis, diabetic coma.

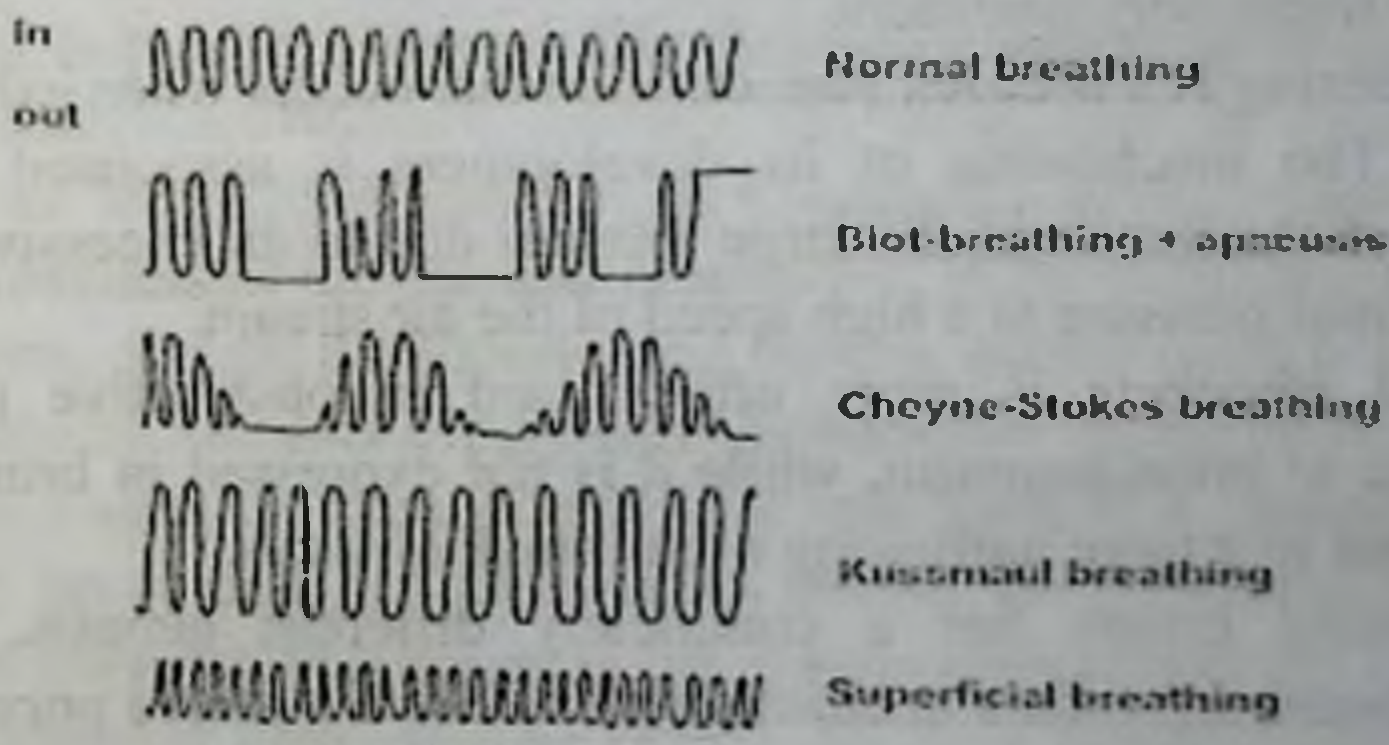
3. Grocco's dissociated breathing is a violation of the coordination function of the neuro-regulatory apparatus, which ensures the harmonious and consistent work of individual groups of the respiratory muscles. This type of breathing is observed in severe conditions: cerebrovascular accidents, brain abscesses, basal meningitis, less often in a diabetic coma, and uremia.

4. Kussmaul breathing is characterized by slow or fast deep respiratory movements involving the auxiliary respiratory muscles



Picture 21. Breath of Kussmaul

The main pathological process that causes this type of breathing is acidosis: diabetic coma, acetonemic vomiting, and metabolic acidosis of any origin.



Picture 22. Pathological types of breathing

Dyspnea (shortness of breath). The concept of "dyspnea" has many different definitions. Dyspnea can be both a subjective sensation and an objective symptom. In the first case, this is a difficulty in breathing experienced by the patient himself or a feeling of lack of air, in the second case, this is an objective symptomatology for the patient and the doctor. A fundamental factor in the interpretation of each case of dyspnea is the deviation of breathing from the norm. The concept of "dyspnea" does not exclude such a situation when the physiological effect of breathing is achieved and maintained with the help of

pathophysiological mechanisms (for example, with the help of tachypnea).

The following forms of shortness of breath are distinguished:

- inspiratory,
- expiratory
- mixed.

Inspiratory dyspnea is observed with obstruction of the upper respiratory tract: croup, congenital narrowing of the larynx, foreign body, etc.

With expiratory dyspnea, the chest is elevated and almost does not participate in the act of breathing. Exhalation is done slowly, sometimes with a whistle. Observed in bronchial asthma.

Mixed shortness of breath - expiratory-inspiratory - is characteristic of bronchiolitis and pneumonia. This definition includes all types of ventilation abnormalities, all degrees of respiratory failure, and other respiratory disorders.

Wheezing is a peculiar phenomenon that occurs when exhalation is difficult. The mechanism of its development is associated with the vibration of the lumen of the large bronchi due to an excessive drop in intrabronchial pressure at a high speed of the air stream.

Loud wheezing is more often heard in obstructive processes, largely due to bronchospasm, while it is not expressed in bronchiolitis, possibly due to a large narrowing of the small airways.

Moaning breath has a completely different genesis. Usually, groaning breathing occurs in children with severe massive pneumonia; it occurs due to difficulty in inhaling due to a decrease in lung compliance and pain caused by concomitant pleurisy.

Respiratory failure (RD) is a condition in which the gas composition of arterial blood is disturbed or maintained at a normal level at the cost of excessive energy expenditure.

The so-called hysterical aphonia is rarely observed in children and is easily recognized since the child's voice becomes silent, but clear and distinct sounds are heard when coughing. The causes of psychogenic aphonia should be sought in the life problems relevant to the child.

Stridor is a breath noise that occurs when air passes through a narrowed airway. Stridor always indicates a narrowing of the airways. It

can be in the inspiratory phase (inspiratory stridor), in the expiratory phase (expiratory stridor), or in both phases of breathing (mixed stridor). In all cases, stridor indicates severe breathing difficulties and is a sign of dyspnea.

Picture 23. Congenital stridor in children

Acute obstruction of the upper respiratory tract due to the narrowing of the larynx and bronchi is the most common cause of acute respiratory failure in children. The following factors predispose to its frequent occurrence: narrow airways, the loose fiber of the subglottic space of the larynx, the tendency of children to laryngospasm, and the relative weakness of the respiratory muscles. In the subglottic space with viral lesions, allergic conditions, and trauma, edema quickly occurs and life-threatening stenosis progresses. Against the background of narrow airways in young children, edema of 1 mm leads to a narrowing of the lumen by up to 50%. In addition to edema, an important role in the genesis of obstruction belongs to the spastic component and mechanical blockage (foreign body, mucus, fibrin). All three pathological factors are present in upper airway obstruction of any origin.

Pneumothorax - accumulation of air or gases in the pleural cavity. It can occur spontaneously in people without chronic lung disease ("primary"), as well as in people with lung disease ("secondary"). Many pneumothoraxes occur after a chest injury or as a complication of medical treatment.

Hydrothorax - (from hydro... and Greek thorax - chest), accumulation of effusion in the pleural cavity.

Chylothorax (accumulation of lymph in the pleural cavity) is caused by mechanical damage to the thoracic duct, lymphosarcoma,

tumor metastases, posterior mediastinal tuberculosis, and leiomyomatosis.

VERIFICATION QUESTIONS

1. What is feature of nasopharyngeal structure in newborn:
A. Low nasal passage is absent
B. Blood supply is bad
C. Nasal passages are wide
D. Cavernous tissue is well developed
2. The larynx is narrow in children till:
A. 6-7 years
B. 3-4 years
C. 8-10 years
D. 12-14 years
3. What part of lung is worse developed in infant?
A. Upper lobe of left lung
B. Upper lobe of right lung
C. Middle lobe of right lung
D. Lower lobe of left lung
4. The respiratory rate in a 1-year-old child is:
A. 30-35
B. 20
C. 25
D. 16-18
5. What percussion sound is heard over normal lung?
A. resonance
B. tympany
C. hyperresonance
D. dullness
6. Striking or tapping the chest surface with the finger is:
A. Direct percussion
B. Indirect percussion
C. Pleximetric percussion
D. Mediate percussion
7. There is an area in normal chest where the percussion sound is tympanic. Where is this area?
A. Below the 5^{th} rib's interspace in the left midclavicular line
B. Between scapulars

C. Above the 2nd rib's interspace in the left midclavicular line

D. Over all the lungs

8. Breathing when inspiration is longer and higher in pitch than that heard invesicular breathing is called:

A. bronchovesicular breathing

B. diminished breath sounds

C. tympany

D. voice sounds

9. In infancy the percussion over the healthy lung normally elicits:

A. Resonance

B. Dullness

C. Hyperresonance

D. flatness

10. In children older than 10 years excursion of the lungs (diaphragmaticexcursion) normally should be about:

A. 2 -4 cm

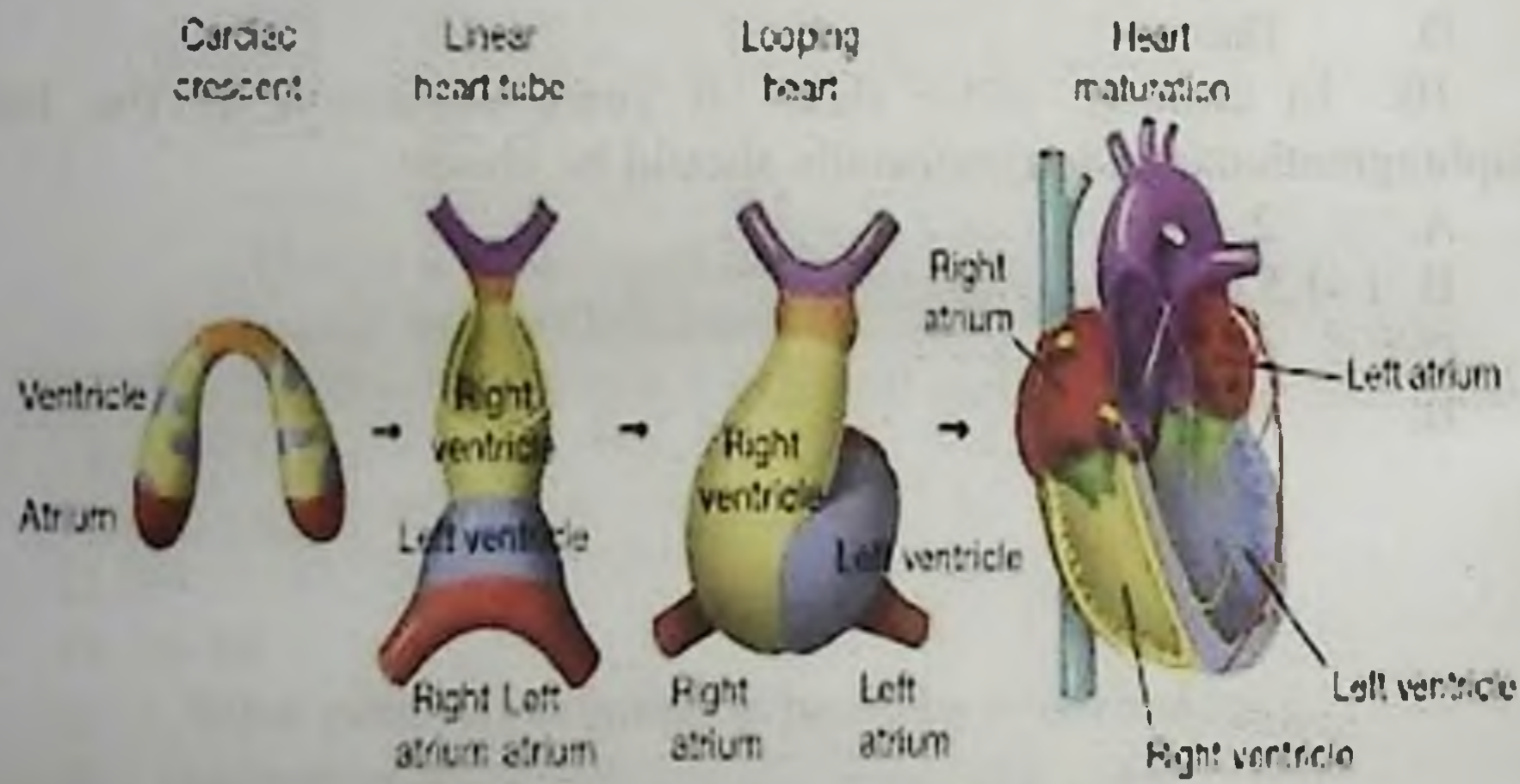
B. 1 -1.5 cm

C. 6 -8 cm

D. 10 cm

4. ANATOMICAL AND PHYSIOLOGICAL FEATURES OF THE CIRCULATORY AND CARDIOVASCULAR SYSTEM

• In the process of development, the heart gradually descends from the cervical region to the chest, where, depending on age, it changes its position (from transverse in a newborn to oblique in a child of 1 year of age). In a newborn, the apex of the heart is projected at the level of the fourth intercostal space on the left, by the age of 5 at the level of the fifth intercostal space, by the age of 10 it almost reaches the level of the apex of an adult.. The mass of the heart in a newborn is on average 24 g, by 8 months it doubles, by 2-3 years it increases by 3 times, by 5 years by 4 times; during puberty, there is an increase in the growth of the heart.



Picture 24. Development of the heart

• Vessels of a newborn differ in position, relation to neighboring organs, the size of their circumference, peculiarities in the structure of the wall, and the degree of development.

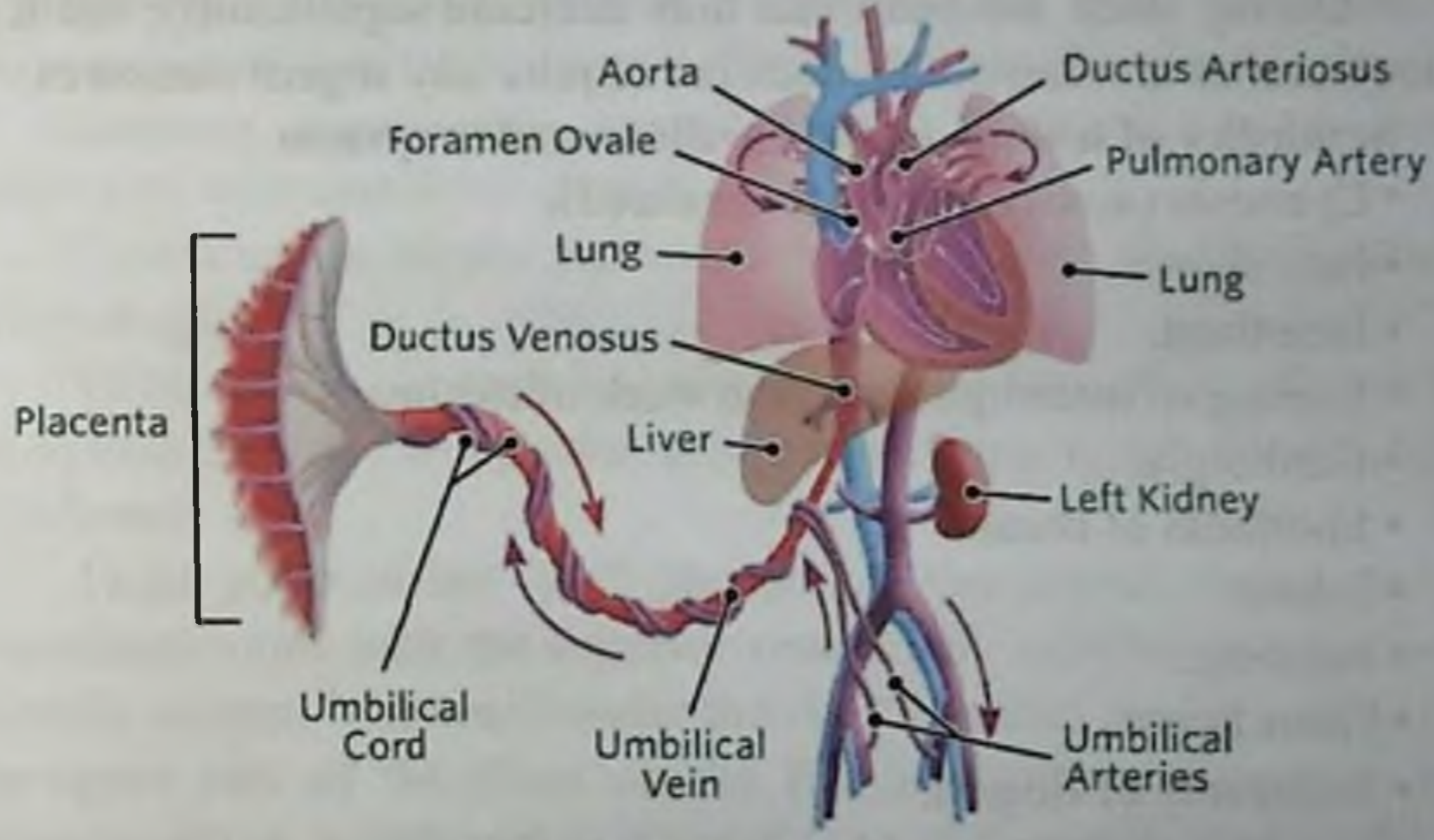
• In young children, the vessels are relatively wide. The capillaries are well developed, which predisposes to stagnation of blood, which is one of the reasons for the more frequent development in children of the first year of life of certain diseases, such as pneumonia and osteomyelitis.

• Arterial pulse in children is more frequent than in adults; this is due to faster contractility of the baby's heart muscle, less effect on the cardiac activity of the vagus nerve, and a higher metabolic rate.

• The highest heart rate (HR) is observed in newborns (120-140 per 1 min). With age, it gradually decreases; by the year, the heart rate is 110-120 in 1 min, by 5 years - 100, by 10 years - 90, by 12-13 years - 80-70 in 1 min.

• The pulse in childhood is characterized by great lability.

Crying, crying, physical stress, and a rise in temperature cause a noticeable increase in it. For the pulse of children, respiratory arrhythmia is characteristic: on inspiration it quickens, on expiration it decreases.



Picture 25. Fetal circulation

• Blood pressure (BP) in children is lower than in adults. It is lower the younger the child. Low blood pressure is due to the small volume of the left ventricle, the wide lumen of the vessels and the elasticity of the arterial walls. To assess blood pressure, age tables of blood pressure are used. The approximate level of maximum blood pressure in children of the 1st year of life can be calculated by the formula: 76 + 2n, where n is the number of months, 76 is the average systolic blood pressure in a newborn.

• In older children, the maximum blood pressure is approximately calculated using the formula: 100 + n, where n is the number of years, with ±15 fluctuations allowed. Diastolic pressure is 2/3 - 1/2 of systolic pressure.

Normal heart rate.

Average frequency per minute:

1st month - 140

1st half - 130

2nd half - 115

2nd year of life - 110

2-4 years - 105

5-10 years - 95

11-14 years - 85

* During sleep, the heart rate may decrease significantly, but if the hemodynamics are stable, this does not require any urgent measures.

Semiotics of lesions of the cardiovascular system

- Cyanosis (acrocyanosis, generalized).
- Pale skin.
- Heartbeat.
- Feeling of interruptions in the work of the heart.
- Cardialgia.
- Shortness of breath.
- Edema.
- Fainting.
- Heart hump.
- Deformity of fingers.

Apex beat changes.

- Pathological pulsation.
- Change in heart rate.
- Arterial hypertension.
- Arterial hypotension.
- Change in the size of the heart and vascular bundle.
- Change in heart sounds.
- Heart murmurs.
- Coronary insufficiency.
- Heart failure.

Fainting (syncope) is a short-term loss of consciousness that occurs with a loss of postural tone. Semiotics of changes in blood pressure. Changes in the level of blood pressure are often found in pediatric

practice: towards both its increase (arterial hypertension) and decrease (arterial hypotension), especially at puberty.

Semiotics of cardiac arrhythmias. Arrhythmias are any heart rhythm that differs from the normal sinus rhythm by changes in frequency, regularity, source of excitation of the heart, and conduction disturbances. Arrhythmias are diverse in origin, and development mechanism, and occur in all age groups, which largely determines the difficulties of diagnosis and treatment tactics.

Semiotics of heart murmurs. Systolic and diastolic, by origin can be organic and functional. Noises in children, like tones, are heard more sonorously and distinctly. They differ in volume, duration, timbre, zone of maximum localization, and area of predominant conduction, connection with systole or diastole.

Functional murmurs can occur in apparently healthy children at different ages.

There are five normal murmurs along the path of blood flow from the systemic veins through the heart to the aorta, which can be defined as follows:

1) the noise of the "top" (junction of the jugular, subclavian, and innominate veins with the superior vena cava): continuous, often with a diastolic accent; best heard under the right clavicle; can be carried out in the upper part of the chest on the left; completely disappears in the supine position, which makes it possible to differentiate it from the noise of an open aortic duct or arteriovenous fistula;

2) noise on the pulmonary artery (connection of the right ventricle with a pulmonary trunk): it is best heard in the 2nd intercostal space at the left edge of the sternum; may be slightly carried up and down; wide, fixed splitting of the second tone suggests that the murmur is pathological and may be caused by an atrial septal defect;

3) the noise of physiological peripheral pulmonary stenosis of newborns (branching of the pulmonary trunk): it is best heard in the upper third at the left edge of the sternum; well carried out in both subclavian regions, back, and also somewhat down along the left edge of the sternum; disappears within the first year of life;

4) atrial vibrating murmur or Still's murmur (connection of the left ventricle to the aorta): it is best heard inwards from the apex or above it;

is carried out medially to the lower and third middle of the left edge of the sternum; usually has a much stronger musical component than any of the other normal noises, and is often described by various terms "vibrating", "groaning", "sounding string";

5) supraclavicular noise, or noise over the carotid artery (connection of the brachiocephalic vessels with the aortic arch): best heard on the neck above the collarbones, usually bilateral; can be carried down to the subclavian region.

Semiotics of heart defects.

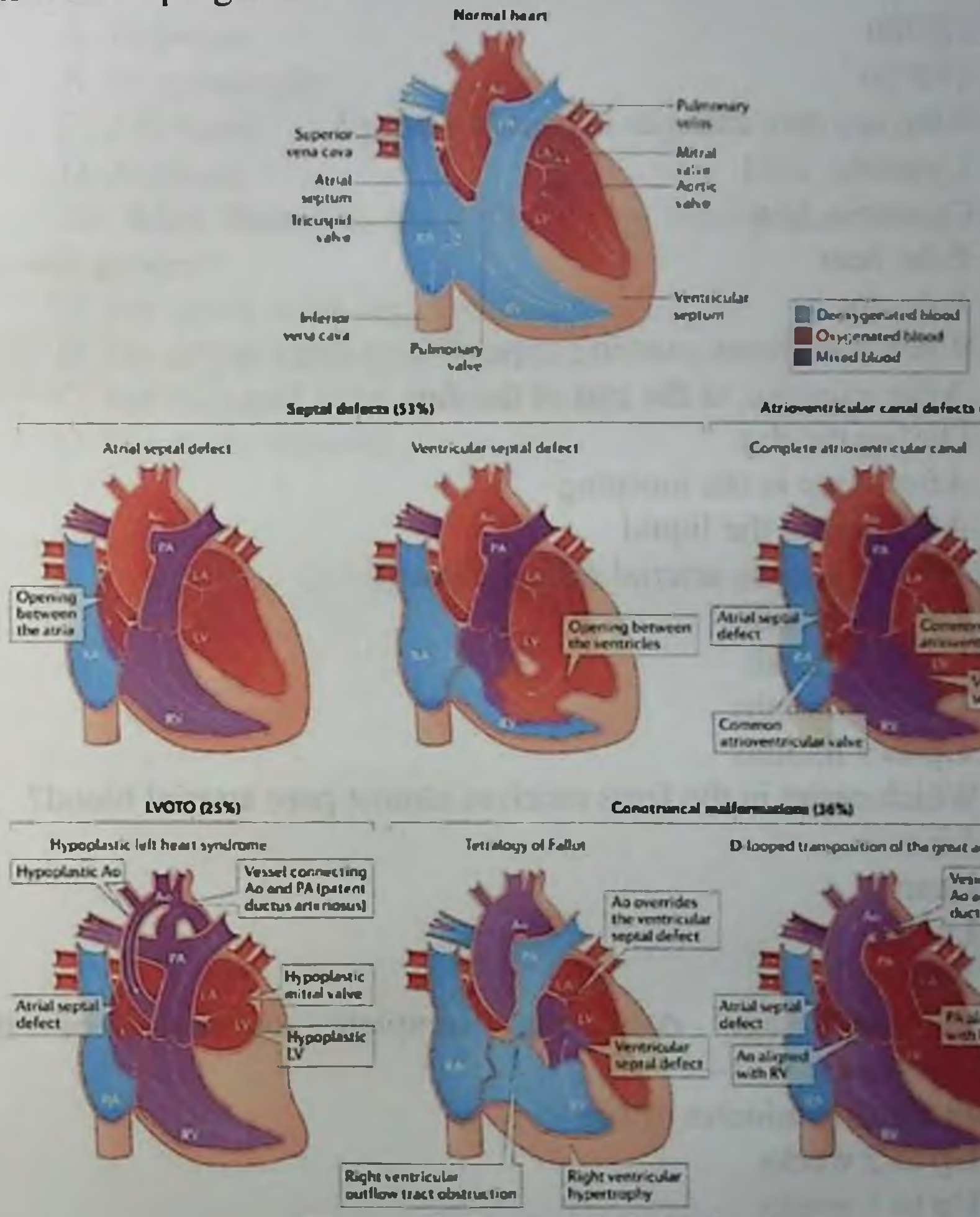
Congenital heart defects. Depending on the characteristics of hemodynamics, CHD are divided into three subgroups.

1. Congenital heart defects with enrichment of the pulmonary circulation. Atrial septal defect (ASD) is one of the most common CHD. There are primary defects (Ostium primum), which, according to the embryological basis, are combined into a group of malformations of the atrioventricular canal (15%), and secondary septal defects (Ostium secundum) -70%. 15% of all ASDs are localized near the orifice of the superior vena cava and the sinus node; multiple defects and complete absence of the atrial septum are less common. In 10-20% of cases, ASD is combined with mitral valve prolapse. Spontaneous closure of an atrial septal defect is more common than previously thought.

2. Congenital heart defects with depletion of the pulmonary circulation. Pulmonary artery stenosis (PSA) is caused more often by stenosis of the valves of the pulmonary artery, less often by sub- and supra-valvular stenosis, stenosis of the branches of the pulmonary artery. Subvalvular stenosis is often part of a complex CHD.

3. Congenital heart defects with depletion of the systemic circulation. Coarctation of the aorta (CA). Narrowing is observed below the outlet from the aorta of the left subclavian artery. Although narrowings can be localized anywhere from the arch to the bifurcation of the aorta, in 98% of cases they are located in the area of the branch of the ductus arteriosus. With preductive stenosis (infantile form), narrowing is observed before the PDA, this form is combined with other defects: VSD, bicuspid aortic valve, transposition of the main vessels, etc.

The postductive form (adult), in which the aortic duct is closed, has a better prognosis.



Picture 26. Congenital heart defects

VERIFICATION QUESTIONS

1. What is the blood pressure of a child of 5 months?

A. 86/40

B. 76/38

C. 90/52

D. 80/34

2. What is blood pressure in a 2 year old child?

A. 94/62
B. 80/40
C. 120/80
D. 110/50
3. What are skin changes in heart swelling?
A. Cyanotic, cold
B. Cyanotic, heat
C. Pale, heat
D. Pale dry
4. When does heart swelling appear?
A. After exercise, at the end of the day
B. During the day
C. After sleep in the morning
D. After taking the liquid
5. At what age the arterial duct is closed?
A. Up to 3 months
B. Up to 1 month
C. Up to 2 months
D. Up to 5 months
6. Which organ in the fetus receives almost pure arterial blood?
A. Liver
B. Heart
C. Lungs
D. Brain
7. At what age does the complete obliteration of the Arantsiy duct occur?
A. In the first minutes of life
B. Up to 2 weeks
C. Up to 3 weeks
D. Up to 6 weeks
8. Which of the following signs clearly indicate the presence of organic heart disease?
A. Diastolic feline purr
B. Pain in the heart
C. Dyspnea
D. Swelling in the lower limbs

9. What does the cause of dyspnea in children with the circulatory failure?

A. Hypoxia

B. Hypokalemia.

C. Alkalosis.

D. Acidosis.

10. What disease is characterized by pronounced pulsation of the carotid arteries?

A. For aortic valve regurgitation

B. For mitral valve insufficiency.

C. For tricuspid valve insufficiency.

D. For aortic stenosis.

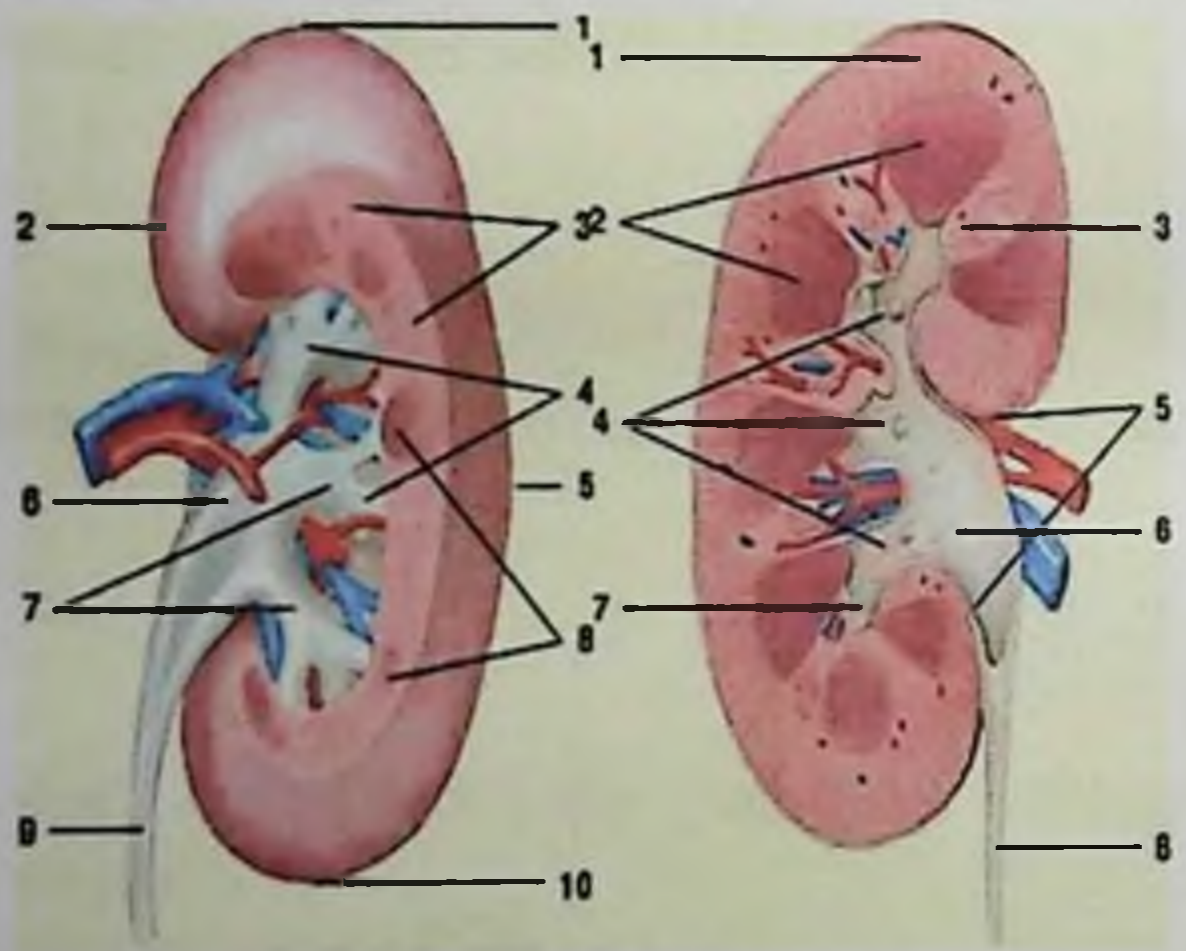
5. ANATOMICAL AND PHYSIOLOGICAL FEATURES OF THE URINARY SYSTEM

• Functions:

1st function: regulation of the composition of the acid-base state of the body and the composition of the extracellular fluid.

2nd function: removal from the body of toxic substances or metabolic products to be removed.

1) The kidneys become the main excretory organ only after the birth of a person, before that the placenta plays the main role. 2) Starting from the end of the 3rd week of the embryonic period, the development of the kidney takes place in 3 stages: pronephros, mesonephros and metanephros. At this time, the formation of such malformations as polycystic kidney disease, agenesis, aplasia and others is possible.



Picture 27. Kidneys

Rice. 4. The structure of the kidneys:

A - rear view (1 - upper pole; 2 - medial edge; 3 - cortical substance of the kidney; 4 - small renal calyces; 5 - lateral edge; 6 - renal pelvis; 7 - large renal calyx; 8 - kidney medulla (pyramids); 9 - ureter; 10 - lower pole;

B- sectional view (1 - kidney cortex; 2 - kidney medulla (pyramids); 3 - kidney column; 4 - large renal cups; 5 - gate kidneys; 6 - renal pelvis; 7 - small renal calyx; 8 - ureter) 3) Morphological maturation of the kidneys ends by 3-5 years, and functional by 6-7 years.

4) At the same time, the kidneys gradually rise from the pelvic region to the lumbar region, making a 900 turn and turning with a

convex edge to the lateral side. At this time, a number of anomalies may develop: a horseshoe kidney, a one-sided pelvic kidney, a dystopic kidney, and others.

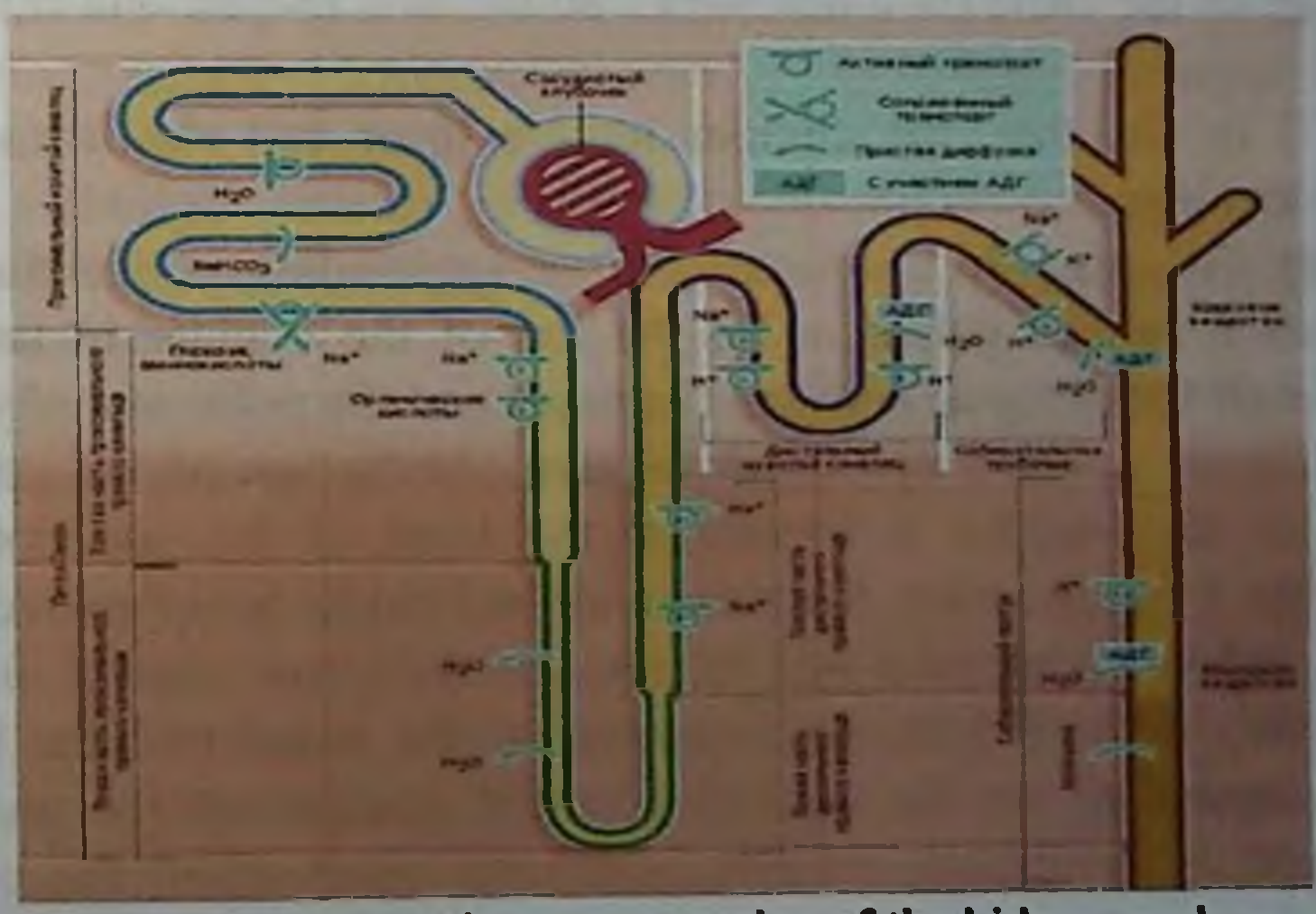
5) With age, the mass and size of the kidneys naturally increase (up to 20 years). But in a child, relative to the size of his body, their value is large (in newborns 1/100 bw, in adults -1/200). In young children, the shape of the kidneys is not bean-shaped, but more rounded, it becomes more elongated after 15 years.

6) Up to 7-8 years of age, the kidneys are located relatively low due to their greater size and shortening of the lumbar spine.

7) Outside, the kidney is covered with a dense fibrous capsule; a fatty capsule surrounds the kidney, which is not expressed in children. Therefore, in children, the kidneys can move down - nephroptosis.

8) In children under 2 years of age, the kidneys are lobular in nature, the cortical layer is underdeveloped (finishes formation by the age of 5). Connective tissue layers are poorly expressed.

9) Up to 2 years of age, the nephron is not sufficiently differentiated. Until the age of 5, a cuboidal epithelium is found in the capsule of the renal glomerulus, which complicates the filtration processes. 10) Glomeruli in infants are located compactly. The size of the glomeruli is small, the total is reduced filtering capacity of the kidneys.



Picture 28. **Schematic representation of the kidney nephron**

11) Tubules (especially in newborns) are short and narrow; reabsorption is reduced (the diameter of the renal corpuscles and urinary tubules increases up to 30 years).

12) Renal pelvis in young children is located mainly intrarenal. They have underdeveloped muscles and elastic tissues. The shape is the same as in adults.

13) The circulatory system of the kidneys in young children is characterized by the predominance of the loose type of branching of the renal artery, the venous network is strongly pronounced, and only by the age of 4 does the branching pattern of the veins inside the kidney differs little from that in adults.

Until the age of 12, the lymphatic system in the kidneys is much better developed, and the valvular apparatus is less pronounced than in adults. Lymphatic vessels are closely related to the lymphatic vessels of the intestine.

14) In children, the ureters have a larger diameter, in newborns, the ureters have a tortuous course, and the muscular membrane at an early age is poorly developed → hypotonic.

15) The bladder in newborns is spindle-shaped, and in children in the first years of life - pear-shaped. During the second childhood (8-12 years) the bladder is ovoid.

16) In children, the capacity of the bladder is in direct proportion to the age of the child (in a newborn - 30 ml, in a 15-year-old child - 400 ml).

17) In children, the circular muscle layer and elastic tissue are poorly developed.

18) The bladder is located higher (protruding above the pubic joint), so it can be palpated. So the top of the bladder in newborns reaches half the distance between the navel and the pubic symphysis and its wall is not covered by the peritoneum. At the age of 1-3 years, the bottom of the bladder is located at the level of the superior pubic symphysis. In adolescents, the bottom of the bladder is at the level of the middle, and in adolescence - at the level of the lower edge of the pubic symphysis. In the future, the lowering of the bottom of the bladder occurs, depending on the condition of the muscles of the urogenital diaphragm.

19) Normal emptying of the bladder for up to a year is a process uncontrolled by higher nervous activity. Bedwetting is acceptable - enuresis (periodic) up to 4-5 years of age

20) In boys, the length of the urethra increases with age (from 5-6 cm to 14-20 cm with acceleration during puberty); poorly developed elastic tissue and connective tissue base.

21) In girls, the urethra is shorter and wider (1-2 cm), and in women - 3-6 cm. These structural features of the urethra in girls are the main reason that they often develop inflammatory diseases of the bladder - cystitis, and pyelonephritis since the infection easily enters the short female urethra into the bladder.

22) The mucous membrane of the urethra in children is very thin, delicate, and easily vulnerable, its folding is weakly expressed.

In children, the ability of the kidneys to maintain homeostasis is reduced.

• low glomerular filtration

• reduced clearance of endogenous creatinine (increases with age, which characterizes an increase in glomerular filtration)

• reduced reabsorption of primary urine (low osmolality, urine concentration; transient glucosuria in newborns with a small sugar load). This is due to the immaturity of the epithelium of the distal tubules.

• low activity of enzymes that provide the release of acid radicals (rapid development of acidosis in various diseases)

• neonates have limited ammonia production (i.e. no reason-saving mechanism)

• increased sodium reabsorption (sodium retention in tissues contributes to the development of edema and other manifestations of hypercalcemia)

• the secretion of various substances is slowed down, especially in newborns, which must be taken into account when prescribing drug therapy.

• At a younger age there is no JGA.

Thus, the compensatory possibilities in children are limited, especially in newborns, who may experience a transient condition - renal failure. In addition, the kidneys of newborns, despite the low osmolarity of urine, are unable to quickly remove excess water from the body (as is normal for adults), which must be taken into account when drawing up a

drinking regimen and nutrition. With various infections, acidosis and hypoxia easily occur.

Semiotics of diseases of the urinary system

• Anomalies in the development of the organs of the urinary system.

• Changes in urine tests (color, smell, density, hematuria, crystalluria, leukocyturia, ketonuria, proteinuria).

• Violations of urination (polyuria, oliguria, anuria, ischuria, nocturia).

• Dysuric syndrome (urinary incontinence, enuresis, stranguria).

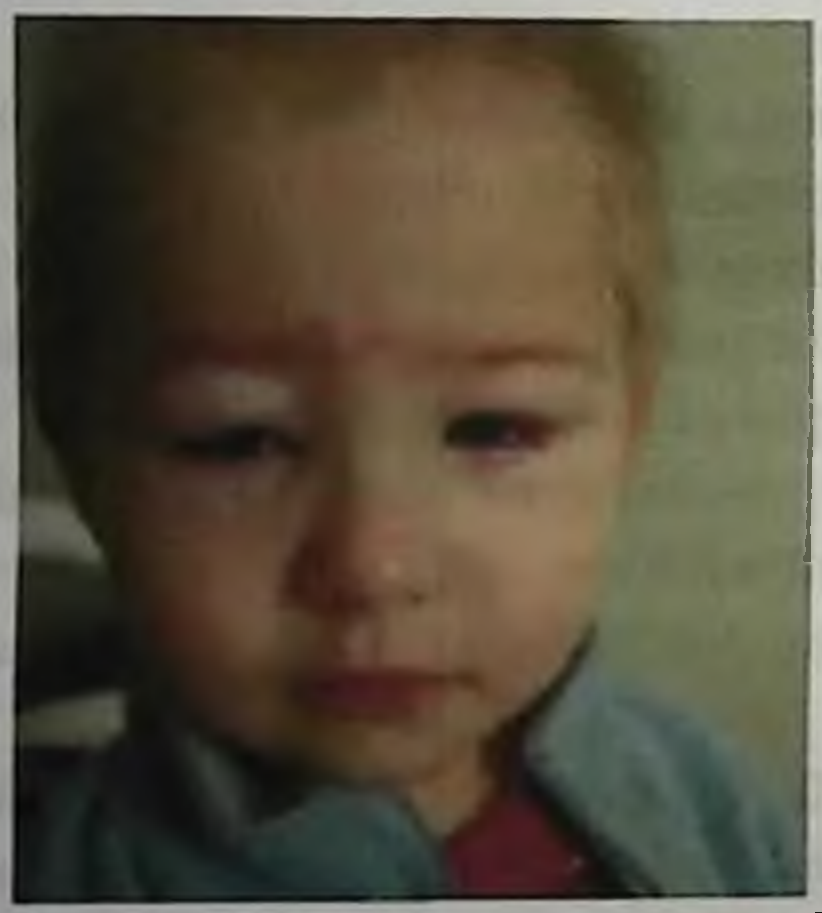
• Nephrotic syndrome.

•Pain syndrome.

• Edema.

•Arterial hypertension.

• Kidney failure.



Picture 29. Edema syndrome in children. Pain syndrome in children.

Semiotics of dysuric disorders.

Dysuric disorders are disorders of the act of urination, which include pain and cramps during urination, frequent or slow urination, night and day incontinence, urinary incontinence, and enuresis - urinary incontinence during sleep (night involuntary urination).

Urinary incontinence is the involuntary release of urine through the urethra or through a fistula (fistula) that connects the urinary tract to the surface of the body. Urinary incontinence is a symptom, not a diagnosis in itself, as it can be caused by a variety of disorders. The degree of

urinary incontinence varies widely and is a medical and social problem in equal measure. Involuntary urination does not threaten the life of the child but causes him and his family great inconvenience and trouble. The disease affects the formation of personality and leaves an imprint on the character and behavior of the child, his development, and school performance.

Pollakiuria is frequent urination in small portions (drops).

An imperative urge is the appearance of an irresistible urge to urinate with a sharp shortening of the time interval (up to several seconds) until the obligatory emptying of the bladder.

Urinary incontinence is passing urine without the urge to urinate. It can be with congenital and acquired diseases of the spinal cord (true), with malformations of the urinary and genital organs (false).

A decrease in urination is the number of urination per day less than the lower limit of standard indicators.

Urinary retention (ischuria) is partial and complete (acute and chronic). Partial urinary retention is characterized by incomplete emptying of the bladder, which is observed when there is an obstruction at the level of the bladder neck and urethra that disrupts the passage of urine. In this case, urinary retention occurs, it is carried out in two stages, with an intermittent stream. Acute complete retention may be the result of stone formation, trauma (rupture) of the urethra, and other causes, chronic - the result of trauma, diseases of the spinal cord, etc.

Oliguria - a decrease in the daily amount of urine - is a sign of a violation of either the production or excretion of urine (diuresis less than 0.5 ml/kg / h or 250 ml / m2 of body surface per day).

There are prerenal, renal and postrenal oliguria.

Polyuria. The term "polyuria" refers to an increase in diuresis by 2 times compared with the norm, or the amount of urine> 1500 ml / m2 per day. A decrease in the water reabsorption coefficient by 1% causes an increase in diuresis by 300-500 ml. Polyuria can be observed under physiological conditions when an excessive amount of liquid is consumed, either out of habit or in connection with mental disorders (diagnosis is helped by a test with dry eating - the concentration ability of the kidneys during the test is normal).

Proteinuria is the appearance of protein in the urine, the amount of which exceeds normal values. Taking into account daily fluctuations in protein excretion in the urine (the maximum amount is in the daytime),

differences in the amount of protein lost in different portions to assess protein loss in the urine, daily proteinuria in the urine of a healthy child is determined up to 100 mg of protein per day (by the Lowry method) and up to 30-60 mg/day (with the Heller ring test).

Proteinuria is also diagnosed with the help of urinary indicator strips. Proteinuria is represented by various types of plasma proteins (30 types), including albumin, as well as a number of tissue proteins (glycoproteins) secreted by the cells of the tubules and the mucous membrane of the urinary organs, including the large Tamm-Horsfall glycoprotein, the origin of which is associated with the cells of the ascending knee of the loop of Henle (with relative weight over 100,000). The rate of its secretion is up to 25 mg per day.

Normal urine protein consists of about 40% albumin, in addition to 10% IgG, 5% light chains, and 3% IgA. The rest is made up of other proteins, mainly the Tamm-Horsfall protein.

Proteinuria occurs alone or in combination with other changes in the urine in the form of erythrocyturia, leukocyturia, cylindric, and bacteriuria, and is also combined with extrarenal symptoms.

Histuria - the appearance in the urine of organ-specific tissue proteins. It is observed in malignant neoplasms of various localization, and tissue necrosis.

Semiotics of hematuria. Hematuria is diagnosed when there are more than 3 erythrocytes in the field of view in the morning portion of urine (more than 1000 in 1 ml of urine according to Nechiporenko or more than 1,000,000 daily urine according to Addis-Kakovsky). Micro- and macrohematuria differ in intensity. In the presence of microhematuria, the color of urine is not changed, and erythrocytes are detected only with microscopy of the urinary sediment (up to 100 per field of view). With gross hematuria, urine has a red or pink color and may be transparent or cloudy (in the form of meat slops). Renal hematuria is due to increased permeability of glomerular capillaries, instability of the glomerular membrane, renal intravascular coagulation, and damage to the interstitial tissue. A characteristic feature of glomerular erythrocyturia is membrane changes in the form of uneven thickening (up to 80% of erythrocytes). Hematuria can be regarded as physiological when a small number of erythrocytes appear in the urine after exercise in athletes or as orthostatic (if the morning portion of urine does not contain erythrocytes). With primary or secondary kidney

damage, renal hematuria develops; in diseases of the lower urinary tract - postrenal hematuria. Hematuria can be isolated or combined with proteinuria, leukocyturia, and cylindric. Bleeding in the area from the renal pelvis to the urethra leads to isolated hematuria without a noticeable increase in the content of protein, cells, and cylinders in the urine. The most common causes of isolated hematuria are stones, trauma, tumors, IgA nephropathy, often tuberculosis, sickle cell anemia, prostatitis

Picture 30. Gross hematuria of varying intensity (urine of the color of "meat slops").

By nature, hematuria is divided into initial (the appearance of blood in the first portion of urine at the beginning of urination indicates damage to the urethra); terminal (hematuria at the end of the act of urination - characteristic of diseases of the bladder); total (uniform distribution of red blood cells during the entire act of urination - indicates the renal origin of hematuria). The main types of hematuria in children are represented by 2 groups - renal, which can be primary and secondary, and postrenal hematuria.

Semiotics of leukocyturia. A sign of leukocyturia is the presence in the analysis of urine of more than 6-8 leukocytes in the field of view.

VERIFICATION QUESTIONS

1. When does pronephros disappear?

A. at the end of 4-th week of gestation

B. at the 1-st week of gestation

C.at the 2-d week of gestation

D.at the 12-th week of gestation
2. Name the abnormality: the kidney is absent but ureter is present.
A. renal aplasia
B. renal agenesia
C. renal dystopia
D. pronephros
3. Define renal functions, EXCEPT:
A. synthesis of proteins
B. excretory function
C. secretory
D. osmoregulation
4. Where are localized normal kidneys on X-ray film:
A. from 1-st to 4-th lumbar vertebrae
B. lower 4-th lumbar vertebrae
C. from 12-th thoraces to 2 lumbar vertebrae
D. in the iliac fosse
5. The basic functional unit of the kidney is:
A. nephron
B. Henle's look
C. proximal canals
D. Bowman's capsule
6. Normal urine output in infant (ml/24hr):
A. 450-500
B. 250-350
C. 200-250
D. 150-160
7. When does mesonephros appear?
A. 5-6 weeks of gestation
B.2-3 weeks of gestation
C.10 weeks of gestation
D. 5 mo of gestation
8. Define features of kidney functions in infant, EXCEPT:
A. reabsorption glucose is increased
B. glomerular filtration is low
C. inadequate reabsorption of sodium from tubules
D. unable to excrete a water load

9. Normal urine output in school children (ml/24hr):
A. 1000-1200
B. 400-500
C. 600-700
D. 1300-1500

10.Average volume of urinary excretion (ml) in infant at 6 mounts old is:
A. 30
B. 5
C. 100
D. 500

6. ANATOMICAL AND PHYSIOLOGICAL FEATURES OF THE NERVOUS SYSTEM

By the time of the birth of a child, his nervous system, compared with other organs and systems, is the least developed and differentiated.

• In newborns, the mass of the brain is relatively large, amounting to 1/8-1/9 of the body weight, while in an adult the brain is 1/40 of the body weight.

• During the first 6 months of life, brain mass increases by 86.3%.

• Between 2 and 8 years of age, brain growth slows down and Subsequently, its mass changes slightly.

• The brain tissue of a child is rich in water, and contains little lecithin and other specific protein substances.

• Furrows and convolutions are weakly expressed, the gray matter of the brain poorly differentiated from white matter.

• After birth, development continues: the furrows become deeper, and the convolutions are larger and longer. New small furrows and convolutions are formed. This process is especially vigorous for the first time in 5 years, which leads to an increase in the total surface of the cerebral hemispheres.

• Gray matter cells, and conductive systems are not completely well-formed, dendrites short, slightly branched.

• The maturation of the cells of the medulla oblongata ends by 7 years. Last of all, during puberty, the differentiation of the cellular elements of the gray matter of the hypothalamic region ends.

• By birth, children have a pyramidal-striatal level organization of movements (chaotic movements, tone predominates flexor muscles).

• The cerebellum is not developed. Movement coordination develops gradually, starting with the eye muscles, which manifest themselves at 2-3 weeks of life by fixing the gaze on a bright object, then begin to follow the moving toy, turning the head, and coordinating the muscles of the neck.

• The dura mater in newborns is relatively thin, fused with the bones of the base of the skull. Soft, rich in vessels and cells, and arachnoid very thin. The subarachnoid space is small.

• The spinal cord is more mature than the brain. There are spinal automatisms at the time of birth. By the age of 2-3, myelination of the spinal cord and roots ends. The spinal cord grows in length more slowly than the spine. The final ratio is established in 5-6 years.

• Conditioned reflex activity. The GM cortex in a newborn is ready for the formation of conditioned reflexes.

At 2-3 weeks of life, a conditioned vestibular reflex is developed to the position for breastfeeding and rocking in the cradle. Then there is a rapid accumulation of conditioned reflexes from all analyzers. A conditioned reflex to a sound stimulus in the form of a protective (blinking) movement of the eyelids is formed by the end of the 1st month of life, and a food reflex to a sound stimulus - at the 2nd.

In the same period, a conditioned reflex to light is formed.

• Thus, in the first place there is the formation of departments that provide vital reactions responsible for the primary adaptation of the child after birth (food, respiratory, excretory, protective).

Semiotics of damage to the nervous system

• Hypoexcitability syndrome.
• Syndrome of hyperexcitability.
• Syndrome of intracranial hypertension.
• Convulsive syndrome.
• Syndromes of movement disorders (muscular hypotension, hypertension, dystonia).
• Neurological syndromes in somatic diseases.

Anatomo-physiological characteristics of NS in children

NS is formed very early - in the first week of embryonic development. In the 5th-6th week, the head and spinal cord begin to form. Corresponding to the period from the 10th to the 18th week of the development of the most intensive division of nerve cells, this period is the critical period of CNS formation.

At birth, the brain is the most developed organ in terms of size. But although the brain has all the structures and folds, the height and depth of the folds have small values. The gray matter is not well differentiated from the white matter, and the myelin sheath is heavy in practical

output. Functional capabilities of the brain are low. The mass of the brain in a newborn baby is equal to 1/8-1/9 of the body mass, at the age of 1 it increases twice to 1/11-1/12 of the body mass, at the age of 5 years - 1/13-1/14, 18 - 20 years old - equal to 1/40 body mass. The smaller the child, the greater the brain mass relative to the body mass. With increasing age, the mass of the brain increases rapidly (Table 1).

Table 1.

Dependence of the average mass of the brain on the age of the organism

Age	Average mass, g		Age years	Average mass, g	
	Boys	Girls		Boys	Girls
Babies	353	347	6-7	1313	1225
0-3 months old	435	411	7-8	1338	1265
3-6 months old	600	534	8-9	1294	1208
6-12 months old	877	726	9-10	1360	1226
1-2 years old	971	894	10-11	1348	1247
2-3 years old	1076	1012	11-12	1378	1259
3-4 years old	1179	1076	12-13	1383	1269
4-5 years old	1290	1156	13-14	1382	1243
5-6 years old	1275	1206	14-15	1356	1318

The nervous tissue of the brain, especially the gray matter, is characterized by a rather strong vascularization. Abundant blood supply meets the oxygen demand of rapidly developing nerve tissue. A nerve cell requires 22 times more oxygen than any somatic cell. Therefore, in most diseases, it very easily falls into oxygen deficiency and shows hypoxic encephalopathy. At the same time, blood flow from brain tissue is slow. Therefore, it often contains more toxic substances. This is also caused by the high permeability of the hematoencephalic barrier.

Brain tissue is richer in protein than other tissues. Because 1g of protein holds 17g of water, this causes more swelling in the brain. With increasing age, the amount of protein decreases from 46% to 27%. By the age of 1.5 years, the amount of water in the brain tissue decreases, and this indicator is the same as in older children.

OM is more advanced than BM at birth. The mass and size of OM increase at a slower rate. A 2-fold increase in SC mass occurs at 10 months, and a 3-fold increase occurs at 3-5 years of age. Its length increases by 2 times at the age of 7-10 years, at the same time it grows a

little slower than the growth of the length of the spine, and therefore the lower end of the spinal cord rises up. This should be taken into account when puncturing the SC.

The amount of cerebrospinal fluid in young children is less than that of adults and gradually increases from 30-40 ml in a newborn to 40-60 ml in a 12-month-old child. Later, it reaches 150 ml in an adult. Age-related changes in cerebrospinal fluid are presented in Table 2.

Table 2.

Age-related changes in spinal fluid

Indicators	Children's age			
	up to 14 days	14 days - 3 months	4-6 months	More than 6 months
color and clarity	often xanthochrome clear	Colorless clear	Colorless clear	Colorless clear
protein, g/l	0.4-0.8	0.2-0.5	0.18-0.36	0.16-0.24
Cytosis in 1 μl	3/3 -30/3	3/3-25/3	3/3-20/3	3/3-10/3
Cells type	mainly lymphocytes, a few neutrophils	basicallylymphocytes	lymphocytes	Lymphocytes
Pandi test	from + to ++	to +	rarely less +	-
Sugar, mmol/l	1.7-3.9	2.2-3.9	2.2-4.4	2.2-4.4

The anatomical structure of the brain in a child is the same as in adults. The most immature brain is that of newborns. It ensures the formation of higher nervous activity and takes place at the age of 5-6 years after other different sections.

The main cell of the nervous system is a neurocyte. There are 16 billion such cells in an adult. Cells entering the brain cortex after birth make up 25% of the available diffuse cells. In a 6-month-old child, they are 66%, at 1 year old - 90-95%, at 1.5 years old, neurocytes are 100% analogous to adult neurocytes. If some factor damages the cells of the brain, it is concluded that the disease should be diagnosed and treated before the age of 18 months. Further treatment will not be effective.

The histological immaturity of nerve cells is also important for childbirth: they are oval in shape, have 1 axon, there is granularity in the nucleus, and there are no dendrites. Their future differentiation consists

of their elongation, axon elongation, branching of dendrites. Myelination and the formation of synapses take place. Differentiation is complete at the age of 6-7.

To the process of normal formation of nerve cells:

- nutrition
- imprinting
- upbringing of the child, kinship ties, completeness of the family and the moral environment in it are affected.

Neuropsychological development (psychomotor development)

Motility

In pediatrics, 2 descriptions are used synonymously to characterize NS: neuropsychological development and psychomotor development.

Evaluation criteria of PMD:

- motor skills
- statics
- conditional-reflector activity
- speech
- is a higher nervous activity.

Motor (movement) is a child's manipulative activity directed towards a specific goal.

The so-called physiological muscle hypertonia is characteristic for a healthy newborn child at rest, and this is a flexed state even during sleep. Muscle hypertonia is expressed symmetrically in all cases of the child. Hands are bent at the joints, pressed to the chest, fingers are pressed into fists, thumbs are brought to the palm of the hand. Also, the legs are bent in all joints and the hips are slightly turned aside, the back (reverse) bending is strong in the soles of the feet. Movements of a newborn baby are limited, chaotic, irregular, athetotic. Tremor and physiological muscle hypertonia gradually fade after a month.

The motility of a healthy child develops later in the following order:

1) In 2-3 weeks, the child stops looking at something bright;

2) The manual activity of his hands develops in the 4th week: the child brings his hands closer to his eyes, looks at them, massages the blanket. In the second half of the year, he takes a bottle with milk and drinks milk from it;

3) At 4-5 months, the coordination of the back muscles develops, which is seen when he turns over on his stomach when lying on his

back, and at 5-6 months when he turns over on his back when he lies on his stomach;

4) At the end of the 1st year, when the child is interested in something and walks to another corner of the room, the process of walking is not a sign of motor skills, but a movement of coordination of all muscles in the necessary direction.

In the future, the development of motor skills - from the first time holding a pencil to the adult playing music on the violin, the piano, drawing, weaving and other manipulations.

VERIFICATION QUESTIONS

1. The physiological muscles hypertonia of the low extremities is kept in infants upto:

A. 4 months
B. 2 months
C. 3 months
D. 5 months

2. The objective neurological investigation of the child includes all items, except:

A. History of present illness
B. Analysis of previous psycho-motor development
C. Estimation level of consciousness
D. Estimation head characteristics (the size, fontanels' condition, function ofcranial nerves)

3. The critical period of development of the central nervous system when seriousanatomical anomalies are formed:

A. 5-6 weeks of gestation
B. 10-18 weeks of gestation
C. 20-22 weeks of gestation
D. 25-28 weeks of gestation

4. Feature of the nervous system in newborns compared with adults is:

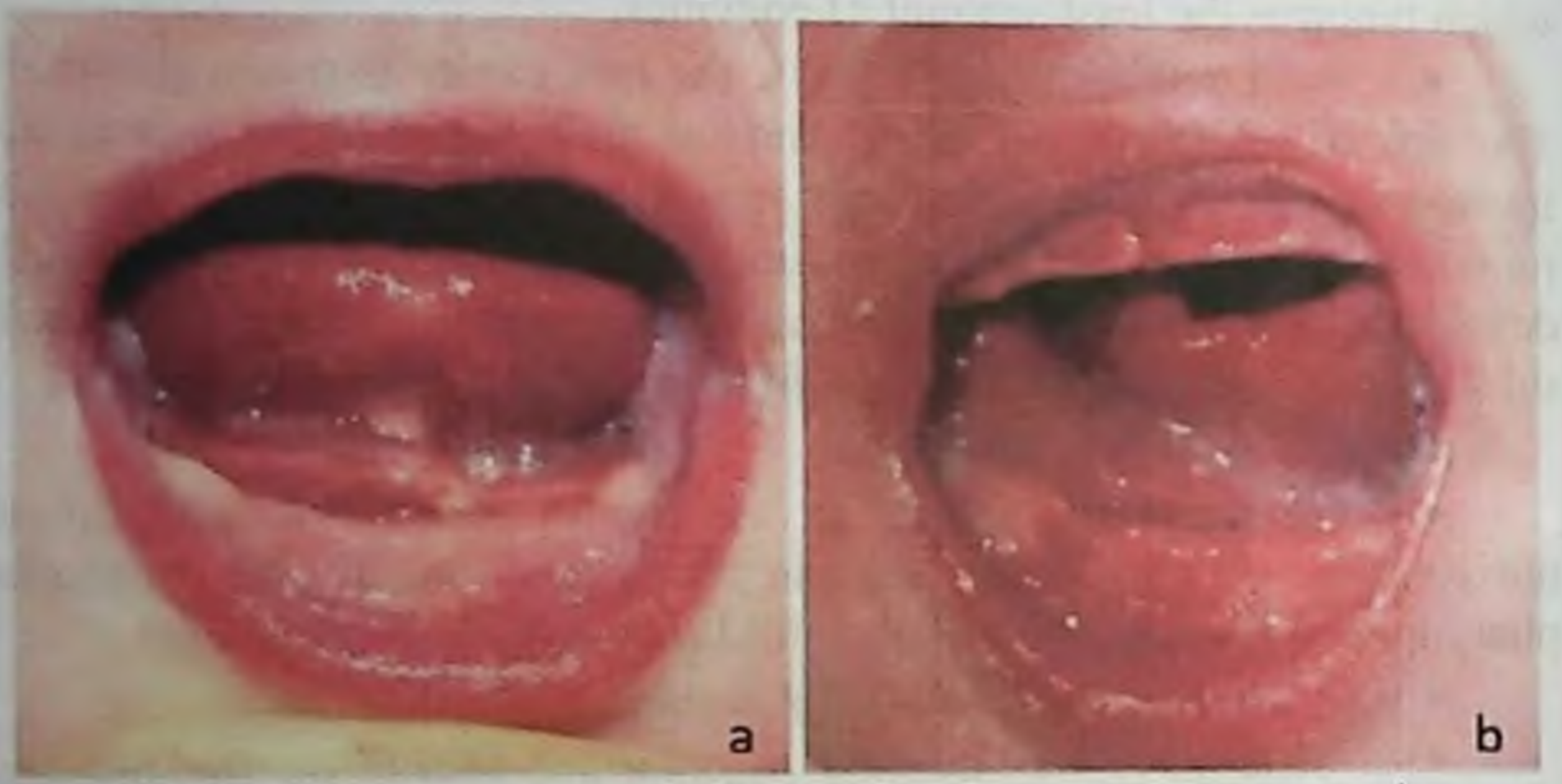
A. The grey substance of brain is not differentiated enough from white
B. Almost all the furrows and convolutions of the brain are present at birth, andthey are well developed.
C. Cerebellum is well developed
Myelination of neurons is well developed

5. Neuronal myelination comes to the end in children aged:
A. 2 years
B. 1 year
C. 7 years
D. 10 years
6. Which symptom is positive with latent hypocalcaemia?
A. Trousseau
B. Babinski
C. Brudzinsky
D. Babkin
7. Which cranial nervous physician investigates, when ask the child clench the teethand chew or swallow some food?
A. V
B. IV
C. VII
D. IX
8. The feature of nervous system in infants is:
A. The high permeability of blood-brain barrier
B. poor blood supply to the brain
C. Well-developed cerebellum
All the furrows and convolutions of the brain are present at birth, they arewell developed
9. The physiological muscles hypertonia of the upper extremities is kept in infants up to:
A. 3 month
B. 2 months
C. 5 months
D. 4 months
10. For meningitis the one of the following symptoms is characteristic:
A. upper Brudzinsky
B. Babinski
C. Trousseau's sign
D. Babinski

7. ANATOMICAL AND PHYSIOLOGICAL FEATURES OF THE DIGESTIVE SYSTEM.

- The digestive organs of the child have several
- morphological and physiological features. These features are most pronounced in young children, in whom the digestive apparatus is adapted mainly for the assimilation of breast milk, the digestion of which requires the least amount of enzymes.
- • In newborns and infants, the oral cavity is relatively small. The lips of newborns are thick, and on their inner surface, there are transverse ridges. The cheeks of newborns and young children are rounded and convex due to the presence between the skin and the well-developed buccal muscle of a “round fat body (Bish's fat lumps), which subsequently, starting from the age of 4, gradually atrophies.
- • The hard palate is flat.
- • The soft palate is relatively short, located almost horizontally. The palatine curtain does not touch the posterior pharyngeal wall, which allows the child to breathe during sucking.
- • The tongue of newborns is short, wide, thick and
- sedentary, well-defined papillae are visible on the mucous membrane, which occupies the entire oral cavity.
- • Transverse folds (rollers) are present on the hard palate, with roller-like thickenings - on the gums.
- All these formations provide sealing of the oral cavity in the process of sucking.
- The salivary glands (parotid, submandibular, sublingual, small glands of the oral mucosa) in the newborn are characterized by low secretory activity and secrete very little thick, viscous saliva, which is necessary for gluing the lips and sealing the oral cavity during sucking.
- The functional activity of the salivary glands begins to increase at the age of 1.5-2 months; in 3-4-month-old children, saliva often flows out of the mouth due to the immaturity of the regulation of salivation and swallowing of saliva (physiological salivation).
- By the age of 7, a child produces as much saliva as an adult. The reaction of saliva in newborns is often neutral or slightly acidic.

- From the first days of life, saliva contains amylase and other enzymes necessary for the breakdown of starch and glycogen.
- The pharynx of a newborn is funnel-shaped. The entrance to the larynx is located high, above the lower posterior edge of the palatine curtain, and is connected to the oral cavity. Food moves to the sides of the protruding larynx, so the baby can breathe and swallow at the same time without interrupting sucking.

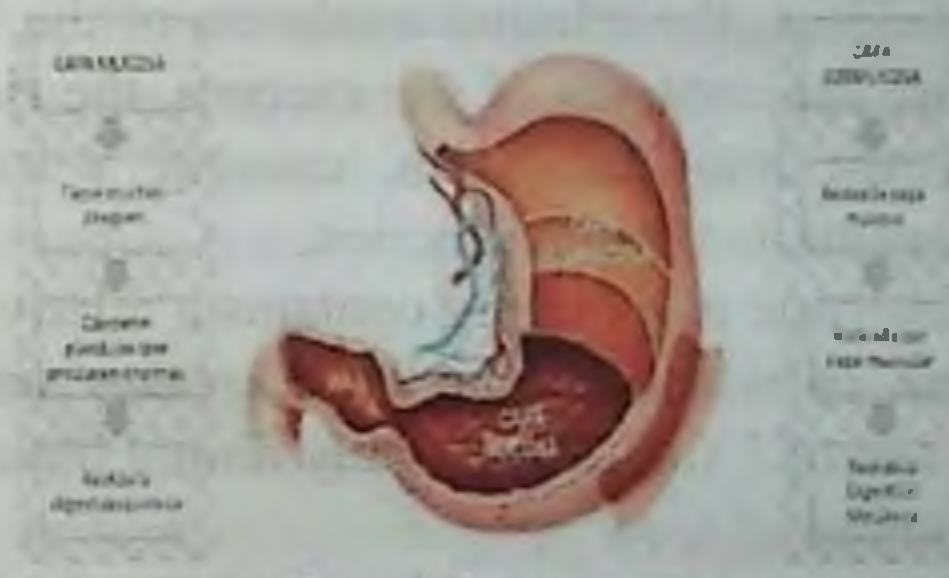


Picture 31. Anatomical and physiological features of the oral cavity

- The stomach of a newborn is shaped like a cylinder, an ox horn, or a fishhook and is set high, as the baby grows and develops the stomach sinks. In infants, the stomach is located horizontally, but as soon as the child begins to walk, it gradually assumes a more vertical position.
- The cardinal part, the bottom, and the pyloric part of the stomach in a newborn are weakly expressed, the pylorus is wide.
- Gubarev's valve, which prevents the return of food, is almost not expressed (it develops by 8-9 months of life), the cardiac sphincter is functionally inferior, while the pyloric part of the stomach is functionally well developed already at birth.
- These features cause the possibility of reflux of the contents of the stomach into the esophagus and the development of peptic lesions of its mucous membrane.
- In addition, the tendency of children in the first year of life to regurgitate and vomiting is associated with the absence of a tight grasp

of the esophagus by the legs of the diaphragm, as well as impaired innervation with increased intragastric pressure. Swallowing air during sucking (aerophagia) also contributes to regurgitation with improper feeding technique, a short frenulum of the tongue, greedy sucking, and too rapid release of milk from the mother's breast.

- The atomic capacity of the stomach of a newborn is 30-35 cm3, by the 14th day of life it increases to 90 cm3.
- Physiological capacity is less than anatomical, and on the first day of life is only 7-10 ml; by the 4th day after the start of enteral nutrition, it increases to 40-50 ml, and by the 10th day - up to 80 ml. Subsequently, the capacity of the stomach increases monthly by 25 ml, and by the end of the first year of life is 250-300 ml, and by 3 years - 400-600 ml.
- • An intensive increase in the capacity of the stomach begins after 7 years and by 10-12 years is 1300-1500 ml



Picture 32. Stomach

• The synthesis of proteolytic enzymes by the chief cells begins in the antenatal period, but their content and functional activity in newborns are low and gradually increase with age. The leading role in the hydrolysis of proteins in newborns is played by fetal pepsin, which has a higher proteolytic activity.

• In infants, there were significant fluctuations in the activity of proteolytic enzymes, depending on the nature of feeding (with artificial feeding, activity indicators are higher).

• In children in the first year of life (unlike adults), a high activity of gastric lipase is noted, which ensures the hydrolysis of fats in the absence of bile acids in a neutral environment.

• Low concentrations of hydrochloric acid and pepsins in the stomach in newborns and infants determine the reduced protective

function of gastric juice, but at the same time contribute to the safety of lg, which comes with mother's milk.

Intestines

The relative length of the small intestine in a newborn is large: 1 m per 1 kg of body weight, while in adults it is only 10 cm.

Duodenum

• The duodenum of a newborn has an annular shape (bends form later). In the upper part of the duodenum, acidic gastric chyme is alkalized, prepared for the action of enzymes that come from the pancreas and are formed in the intestine, and mixed with bile. The duodenum has a regulatory effect on the entire digestive system through hormones secreted by the endocrine cells of its mucous membrane.

• The jejunum occupies approximately 2/5 and the ileum 3/5 of the length of the small intestine (excluding the duodenum). The ileum ends with an ileocecal valve (Bauhinia valve).

• In young children, the relative weakness of the ileocecal valve is noted, and therefore the contents of the caecum, the richest in bacterial flora, can be thrown into the ileum, causing a high incidence of inflammatory lesions of its terminal section.

• The small intestine of an infant contains a relatively large amount of gas, the volume of which gradually decreases until it disappears completely by the age of 7 (adults normally do not have gas in the small intestine).

• The mucous membrane is thin, richly vascularized, and has increased permeability, especially in children in the first year of life.

• The muscular coat, especially its longitudinal layer, is poorly developed in newborns. The mesentery in newborns and young children is short, increasing significantly in length during the first year of life.

• In the small intestine, the processes of splitting and absorption of nutrients occur with the combined action of intestinal juice, bile, and pancreatic secretions. The secretory apparatus of the small intestine is generally formed by birth and secretes enzymes: enterokinase, alkaline phosphatase, lipase, amylase, maltase, and nuclease, but their activity is lower and increases with age.

• Due to the low activity of lipase, the process of digestion of fats is especially intense.

• Fermentation in the intestines of infants complements the enzymatic breakdown of food. There is no rotting in the intestines of healthy children in the first months of life.

Colon

• The large intestine in a newborn has an average length of 63 cm. By the end of the first year of life, it lengthens to 83 cm, and subsequently, its length is approximately equal to the height of the child. The newborn does not have omental processes (they appear in the 2nd year of the child's life), the bands of the colon are barely visible, and the haustral of the colon is absent (they appear after 6 months). Colon bands, haustra, and omental processes are finally formed by the age of 6-7 years.

• The caecum in newborns has a conical or funnel-shaped shape, its width prevails over its length.

The ileocecal opening is annular or triangular, gaping. In children older than a year, it becomes slit-like. The appendix in a newborn has a cone-shaped shape, the entrance to it is wide open (the valve is formed in the first year of life), and mobile. After birth, lymphoid follicles appear in the appendix, reaching their maximum development by 10-14 years.

• The colon surrounds the loops of the small intestine. The ascending part of the newborn is very short (2-9 cm) and increases after the colon takes its final position. It is weakly mobile and rarely has a mesentery.

• The sigmoid colon in a newborn is relatively long (12-29 cm) and mobile. By the age of 7, the intestine loses its mobility as a result of the shortening of the mesentery and the accumulation of adipose tissue around it. The large intestine provides water resorption and evacuation-reservoir function. It completes the absorption of digested food, breaks down the remaining substances (both under the influence of enzymes coming from the small intestine and bacteria that inhabit the large intestine), and the formation of feces occurs.

• The mucous membrane of the large intestine in children is characterized by a number of features: deepened crypts, flatter epithelium, and a higher rate of its proliferation. Juice secretion of the colon under normal conditions is insignificant; however, it sharply increases with mechanical irritation of the mucous membrane.

Rectum

• The rectum of a newborn is cylindrical in shape, has no ampulla (its formation occurs in the first period of childhood), and bends (forms simultaneously with the sacral and coccygeal bends of the spine), its folds are not expressed.

• In children in the first months of life, the rectum is relatively long and poorly fixed, since fatty tissue is not developed. The rectum occupies the final position by 2 years.

In a newborn, the muscular membrane is poorly developed.

• The anus in children is located at a distance of 20 mm from the coccyx.

defecation

• During the first hours of life, meconium (original feces) is passed - a sticky mass of dark green color with a pH of about 6.0. Meconium consists of desquamated epithelium, mucus, remnants of amniotic fluid, bile pigments, etc. On the 2-3rd day of life, feces are mixed with meconium, and from the 5th day, feces take on a characteristic appearance for a newborn. In children of the first month of life, defecation usually occurs after each feeding - 5-7 times a day, in children from the 2nd month of life - 3-6 times, in 1 year - 1-2 times. With mixed and artificial feeding, defecation is rare.

Picture 33. Meconium

• Cal in children who are breastfed, mushy, yellow, sour reaction and sour smell; with artificial feeding, the feces have a thicker

consistency (putty-like), lighter, sometimes with a grayish tint, neutral or even alkaline reaction, more pungent odor. The golden yellow color of feces in the first months of a child's life is due to the presence of bilirubin, greenish - biliverdin.

• In infants, defecation occurs reflexively, without the participation of the will. From the end of the first year of life, a healthy child is gradually accustomed to the fact that defecation becomes an arbitrary act.

Microflora of the gastrointestinal tract.

• The intestines of the fetus and newborn are sterile during the first 10-20 hours (aseptic phase).

• Then colonization of the intestine by microorganisms begins (second phase), and the third phase - stabilization of the microflora - lasts at least 2 weeks.

• The formation of intestinal microbial biocenosis begins from the first day of life, by the 7-9th day in healthy full-term children, the bacterial flora is usually represented mainly by Bifidobacterium bifidum, Lactobacillus acidophilus.

• With natural feeding, B. bifidum prevails among the intestinal microflora, with artificial feeding, L. acidophilus, B. bifidum, and enterococci are present in almost equal amounts.

Pancreas.

• The proteolytic activity of the secret of the pancreas in children during the first months of life is quite high, it reaches a maximum at the age of 4-6 years.

• The type of feeding has a significant impact on the activity of the pancreas: with artificial feeding, the activity of enzymes in the duodenal juice is 4-5 times higher than in the natural one.

Liver

• The liver at the time of birth is one of the largest organs, its lower edge protrudes significantly from under the hypochondrium, and the right lobe can even touch the iliac crest.

The initial mass of the liver doubles in 8-10 months. and triples by 2-3 years.

• Enzymatic systems of the liver, which provide adequate metabolism of various substances, are not mature enough at birth. Artificial feeding stimulates their earlier development, but leads to their disproportion.

Semiotics of lesions of the digestive system

- Change in appetite.
- Change of saturation.
- Thirst.
- Increasing salivation.
- Unusual taste in the mouth.
- Violation of swallowing.
- Belching and heartburn.
- Nausea and vomiting.
- Stomach ache.
- Jaundice.
- Flatulence.
- Diarrhea.
- Constipation.
- Change in feces.
- Change in the shape of the abdomen.
- Change in peristalsis.
- Enlargement of the liver.
-Splenomegaly.

Semiotics of changes in appetite.

Anorexia (anorexia) - unwillingness or refusal to eat, loss of appetite (hypoxia). It should not be confused with sitophobia - the fear of eating because of the resulting pain or discomfort associated with eating.

The increased appetite (hyperoxia), polyphagia (polys - a lot, phagein - to eat) or "wolfish appetite" - bulimia (bus - bull, limos - hunger) make you see a doctor only with an unusually large increase in the child's body weight since parents are always happy with an increased his appetite and regard it as a manifestation of health, traditions should be taken into account when everyone in the family is full and eats a lot. The organic causes of increased appetite in children are diabetes mellitus, chronic pancreatitis, and thyrotoxicosis. Bulimia may be the result of massive corticosteroid therapy. Inflammatory lesions of the brain stem and residual effects of encephalitis can lead to bulimia, which is associated with dementia and often with diabetes insipidus. Helminthiases, especially the defeat of tapeworms, are often accompanied by increased appetite. The development of bulimia can be facilitated by violations of intra-family relationships - a conflict between

mother and child, apparent or actual abandonment, deprivation of affection - when a child finds a substitute for positive emotions in food.

Perverse appetite (parapraxis) - a pathological craving for inedible substances such as earth, plaster, paper, coal, etc. - is observed in moronic, neglected children and in neuropathy. Taste perversions may indicate an iron deficiency due to a monotonous milky meaty diet.

Semiotics of dyspeptic disorders

Nausea is an unpleasant, painful subjective sensation that precedes or accompanies vomiting. It is usually associated with the reduced functional activity of the stomach and changes in the motor function of the duodenum and small intestine. Nausea occurs with an increase in intraduodenal pressure, which is why it is especially characteristic of diseases of the duodenum: duodenitis, gastroduodenitis, and duodenal ulcer.

Nausea associated with vomiting is accompanied by changes in the activity of the autonomic nervous system (especially parasympathetic): pallor of the skin, increased sweating, profuse salivation, weakness, dizziness, tinnitus, often hypotension and bradycardia (vasovagal syndrome).

Vomiting (vomitus) is the reflex act of expelling the contents of the stomach through the mouth.

Regurgitation is the return of food from the stomach to the oral cavity without signs characteristic of vomiting. It is often observed with gastroesophageal reflux, with mechanical or functional (achalasia) narrowing of the esophagus.

Rumination is the repeated involuntary regurgitation of recently eaten food that is either spit out or re-swallowed.

Dyspepsia (indigestion) - the presence of abdominal pain or discomfort in the upper abdomen, while there may be other symptoms (nausea, heartburn, belching, feeling full and full, bloating, etc.). Symptoms may or may not be related to food intake. The term "chronic dyspepsia" is used when symptoms persist for 3 or more months. The main signs indicating the presence of dyspepsia are abdominal pain or discomfort, the feeling of fullness after eating, bloating, belching, early satiety, anorexia, nausea, vomiting, heartburn, and regurgitation.

Distinguish organic and inorganic dyspepsia.

Heartburn is a feeling of heat or burning along the esophagus, in the retrosternal region - observed with gastroduodenal reflux, and

esophagitis and is caused by the reflux of acidic stomach contents into the esophagus.

Belching is the involuntary release of gas into the oral cavity from the stomach or esophagus, sometimes with small portions of the contents of the stomach. Belching occurs due to intragastric pressure against the background of insufficiency of the cardiac sphincter.

Flatulence (gassing) occurs with constipation, accompanied by putrefactive fermentation. Most often, gases come out during bowel movements. Conscious release of gases indicates that they accumulate in large quantities in the large intestine.

Chair changes. Polyfecalia is characteristic primarily of malabsorption syndrome. So, with disaccharidase deficiency, liquid foamy feces without pathological impurities, and a sharply acidic reaction (pH less than 6) are characteristic. With celiac disease, the feces are homogeneous, without pathological impurities, light yellow in color, and cacopara. Intolerance to cow's milk proteins is usually observed in children in the 1st year of life and is clinically manifested by signs of atopic dermatitis and celiac-like syndrome.

Polyfecal and stool disorders in chronic pancreatitis are caused by a violation of the topography of the cavity and membrane digestion due to enzymatic deficiency.

Hungry stool resembles dyspeptic, but is usually thicker, darker, and may contain mucus. Sometimes hungry stools are crumbly.

With simple dyspepsia, the stool is liquid, contains an admixture of greenery (due to the rapid transit of biliverdin impurities through the intestines) and white lumps (a large number of calcium soaps), a sour smell, often foamy (fermentative dyspepsia).

Soapy-calcareous stools are greyish-white, dry, formed, offensive, and alkaline. It contains an increased amount of calcium, magnesium, free fatty acids, and neutral fat. Soapy stool indicates putrefaction in the large intestine, it is observed in infants with the abuse of cow's milk.

Neuropathic diarrhea - regular diarrhea during mental stress (fright, acute reactions of fear, departure of parents, etc.), while often the anamnesis indicates a family predisposition to such phenomena. Confirmation of the diagnosis is the positive effect of sedative and anticholinergic drugs.

The main scatological syndromes.

Constipation is a prolonged (more than 48 hours) delay in bowel movement, accompanied by difficulty in the act of defecation, as well as a small amount (less than 100 g per day) or increased hardness of feces, a feeling of incomplete emptying of the intestine. Constipation can be organic and functional.

Diarrhea (diarrhea) - frequent bowel movements with the release of liquefied, and in some cases, profuse bowel movements. The reason, in any case, is a violation of the processes of digestion, absorption, and transport of essential nutrients in the intestines. There are four types of diarrhea:

osmotic, secretory, motor and exudative.

Semiotics of abdominal pain

Umbilical (abdominal) colic - cramping recurring pain - indicates increased peristalsis or overstretching of some sections of the intestine (accumulation of gases, strong contraction of the intestine in front of an obstruction in its lumen). These colic often occur in sensitive and vegetatively labile children aged 4-12 years.

They occur either during a meal or after it under the influence of effect, mostly localized around the navel, combined with autonomic symptoms (pallor, nausea, vomiting, etc.). Spasmodic pains are found in colitis, and enterocolitis, in the presence of adhesive processes.

Intense and prolonged colicky pains in the right hypochondrium are characteristic of diseases of the liver and biliary tract.Visceral, autonomic pain comes from the organs, the sensitive innervation of which is provided by the parasympathetic and sympathetic nervous system.

At the same time, the pain is diffuse, dull, and painful, and its intensity changes and weakens over time, localized in the depths of the abdominal cavity.

It is accompanied by vegetative changes in the form of vomiting, nausea, pallor, profuse sweat, palpitations, and general restlessness. Pains of various natures (dull, aching in water cases, acute, excruciating - in others) occur with lesions of the pancreas.

"Reflected" pain is a manifestation of the reflex mechanism of visceral pain conduction along sensitive cerebrospinal nerves. In this case, hypersensitivity occurs in certain areas of the skin and increased pain sensitivity (Zakharyin-Ged zones). Irradiation of pain in the right

shoulder, and shoulder blade occurs in diseases of the liver and biliary tract. Irradiation to both hypochondria is characteristic of duodenitis, and pancreatitis, with the latter, also occurring in the back, and lower back.

Symptom complexes of hyperbilirubinemia are pathological conditions characterized by an imbalance between the formation and release of bilirubin, the main clinical sign of which is jaundice (icterus) - yellow pigmentation of the skin or sclera with bilirubin, due to an increase in the content of total bilirubin in the blood serum.Syndromes of liver damage. The cytolytic syndrome occurs due to violations of the structure of liver cells. Mesenchymal-inflammatory syndrome indicates the activity of the pathological process in the liver. Clinically characterized by fever, arthralgia, lymphadenopathy, splenomegaly, and vasculitis (skin, lungs). The cholestatic syndrome is characterized either by a primary (dysregulation of the bile-secreting mechanisms of hepatocytes) or a secondary violation of bile secretion. A secondary violation of bile secretion develops in cases of biliary hypertension, which in turn is associated with an obstruction of the normal flow of bile in the biliary tract.

Clinical manifestations: persistent pruritus, jaundice, skin pigmentation, xanthelasma, dark urine, light stool.

Acute liver failure. It is defined as an acute and progressive deterioration of liver function that develops in children mainly with malignant forms of viral hepatitis B, C, D, or other diffuse liver lesions, acute poisoning, as a complication of previous congenital diseases, anatomical or metabolic disorders. In young children, it often develops with viral hepatitis (B, C, D), poisoning with hepatotropic poisons (mushrooms - pale grebe, lines, fly agaric, etc.).

There are 4 stages of hepatic coma:

1st - change in emotional reaction (euphoria);

2nd - confused consciousness and disorientation, the reaction to simple commands persists;

3rd - stuporous state, reaction to pain persists irritants;

4th - coma, decortication posture, no reaction to painful stimuli; the development of cerebral edema is possible, the mechanism of the latter has not been fully elucidated and, possibly, is due to a violation of the blood-brain barrier.

Hepatomegaly. The liver in newborns and children in the first year of life protrudes from the hypochondrium by 1-2 cm. The physiological norm is the location of the liver 1 cm below the costal arch in preschool children. Hepatomegaly - enlargement of the liver - the most common symptom of liver disease. As a manifestation of visceroptosis in people with asthenic physique, in several diseases (including rickets, myopathies, etc.), the edge of the liver can protrude 1-3 cm down from the costal arch in children of different ages. In this regard, to clarify the genesis of such an "increase", it is necessary to determine the size of the liver according to Kurlov. Pathological enlargement of the liver can be due to various reasons.

VERIFICATION QUESTIONS

1. What enzyme does saliva contain?

A. amylase

B. pepsin

C. lactase

D. lipase

2. Bile is important for digestion because it:

A. forms fats emulsion and increases ones absorption

B. increases the absorption of amino acids

C. decreases the absorption of fatty acids

D. increases the absorption of monosaccharide

3. Most of the remaining water and electrolytes is absorbed from the:

A. Proximal colon

B. stomach

C. small intestine

D. distal colon

4. Normally the lower edge of the liver is palpable in infants:

A. 1-2 cm below the right costal margin

B. is not palpable

C. 3 cm below the right costal margin

D. 4 cm below the right costal margin

5. Where can be the normal liver edge felt in 8-year-old child?

A. Liver is not palpable

B. 3.5 cm below the right costal margin in the right midclavicular line

C. 3 cm below the right costal margin in the right midclavicular line

D. 2 cm below the right costal margin in the right midclavicular line

6. What is the principal absorbing site in the GI system?

A. small intestine

B. stomach

C. Proximal colon

D. distal colon

7. During percussion along the right midclavicular line the upper edge of livernormally fine at which area?

A. The 5^{th} to 7^{th} intercostal space

B. The 3^{rd} to 5^{th} intercostal space

C. The 7^{th} to 9^{th} intercostal space

D. 9^{th} to 10^{th} intercostal space

8. What is a highly sensitive indicator of hepatocellular damage?

A. the rises in alanine aminotransferase (ALT) activities

B. hypoalbuminemia

C. the rises level of bile acids

D. the rises in alkaline phosphates activities

9. All the following statements about the oral cavity in young infant are true,except:

A. Saliva production is increased from birth

B. The mouth is relatively small

C. The tongue is relatively big in size

D. The mucous membrane is good vascularized and dry

10. The feature of gastric secretion in infants is:

A. all of the above

B. Enzyme components is similar to the adult

C. Gastric juice has low proteolysis activity

D. Volume of Gastric juice secretion the low

8. ANATOMICAL AND PHYSIOLOGICAL FEATURES OF THE BLOOD SYSTEM.

In the peripheral blood of the newborn, increased

hemoglobin concentration (180-240 g / l), erythrocyte content (5-7x10^{12} /l) and color index value (0.9-1.3), which indicates intense erythropoiesis as a reaction to insufficient oxygen supply to the fetus during fetal development and in childbirth. After birth, due to the establishment of external respiration, hypoxia is replaced by hyperoxia. This leads to a decrease in the production of erythropoietins and, as a result, to the suppression of erythropoiesis and a decrease in the number of red blood cells and hemoglobin concentration. In addition, erythrocytes containing fetal hemoglobin have a shortened lifespan (only 12 days) and are more susceptible to hemolysis.

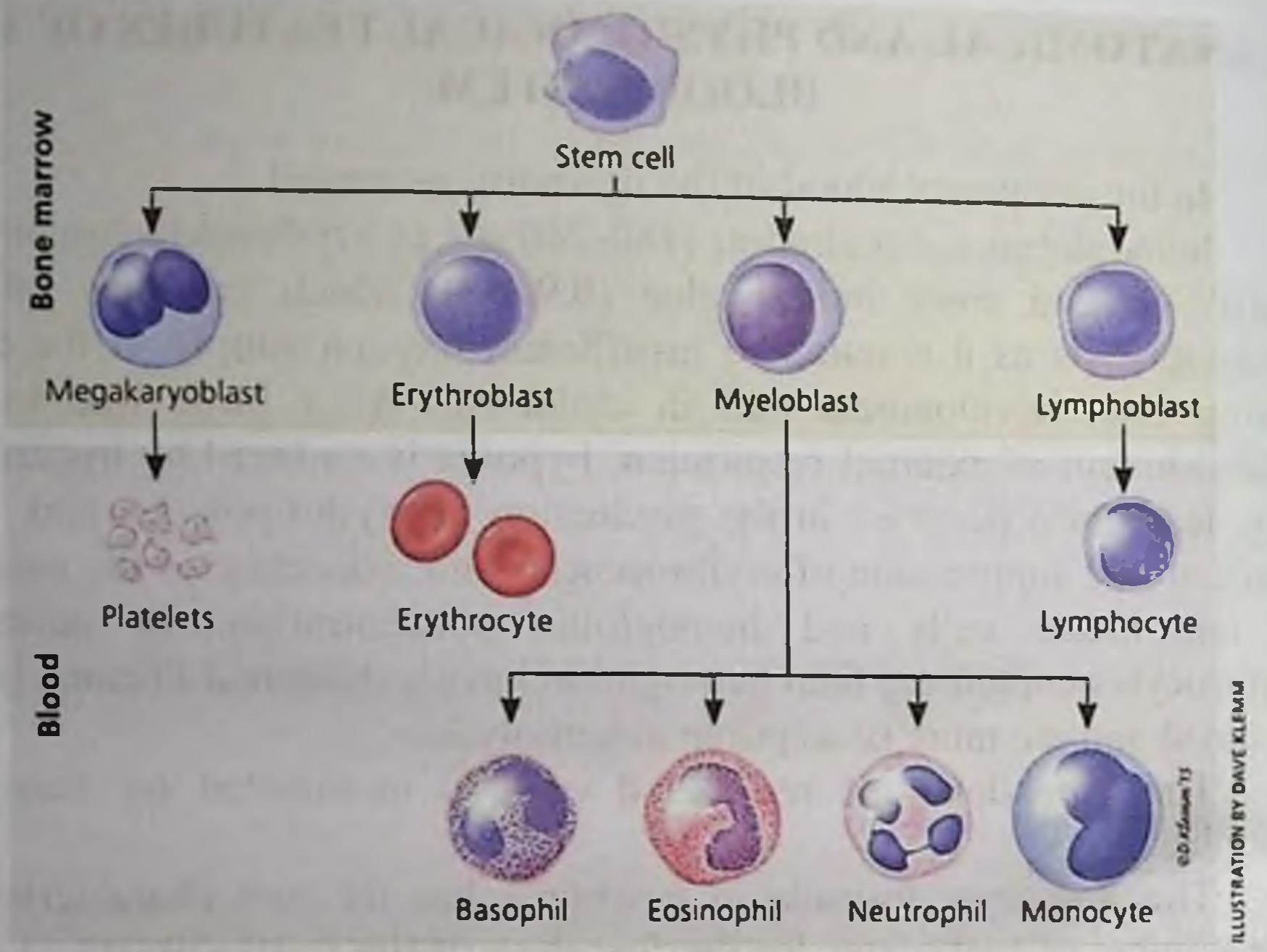
The breakdown of red blood cells is manifested by transient jaundice.

The leukocyte formula in newborns has its own characteristics. The number of leukocytes for the first days of life is 10 -30x10^9 / l. and from 2 weeks of life - 10 - 12x10^9 / l.

Neutrophilia with a shift to the left to myelocytes, which occurs at birth, begins to decline rapidly, and the number of lymphocytes increases, and on the 5-6th day of life, the number of neutrophils and lymphocytes is compared, amounting to 40-45% (first physiological cross). Since that time, lymphocytosis up to 50-60% or more has become a normal indicator in children under 5 years of age.

The content of platelets during the neonatal period averages 150-400x10^9 / l. The erythrocyte sedimentation rate in newborns is slow (1-2 mm/h).

In the first year, a gradual decrease in erythrocytes and hemoglobin continues. In the leukocyte formula after 3-4 years, a tendency to a moderate increase in the number of neutrophils and a decrease in the number of lymphocytes is revealed. Between 5 and 6 years of age, the second physiological crossover of the number of neutrophils and lymphocytes occurs towards an increase in the number of neutrophils.



Picture 34. Blood cells

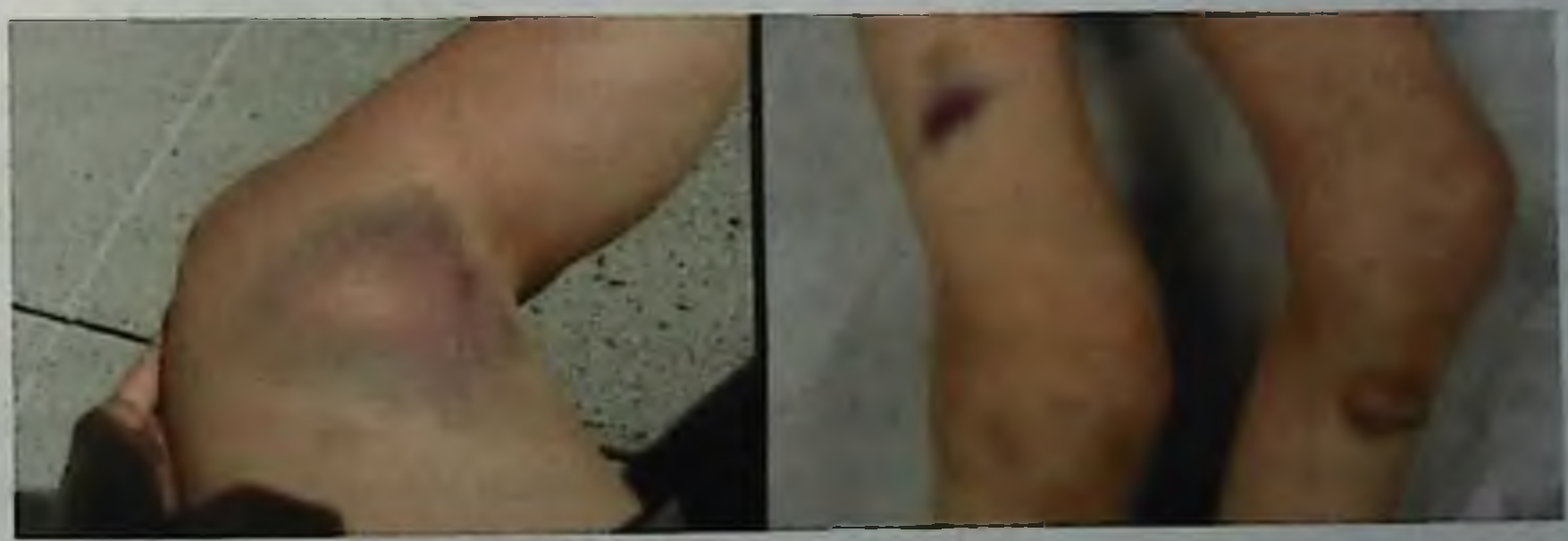
Semiotics of blood diseases.

- Erythrocytosis.
- Reticulocytosis.
- Basophilic granularity of erythrocytes.
- Poikilocytosis.
- Neutrophilic leukocytosis.
- Leucopenia.
- Agranulocytosis.
- Eosinophilia.
- Eosinophilopenia.
- Lymphocytosis.
- Lymphopenia.
- Monocytosis.
- Monocytopenia.
- Thrombocytosis.
- Thrombocytopenia
- Coagulopathy.

Semiotics of hemorrhagic syndrome.

The term "hemorrhagic syndrome" refers to increased bleeding in the form of bleeding from the mucous membranes of the nose, the appearance of hemorrhages in the skin and joints, gastrointestinal bleeding, etc. Separate episodes of increased bleeding can be separated from each other in a child with hereditary defects in hemostasis for many months and even years, and then occur quite often. In this regard, for the diagnosis of hereditary hemostasis defects, a carefully collected anamnesis is extremely important not only for the patient himself but also for all his relatives. At the same time, it is necessary to find out the type of bleeding in the patient and relatives with a thorough analysis of the minimum signs of bleeding: periodic skin hemorrhagic syndrome, nosebleeds or bleeding after injuries, cuts, the duration of menstrual bleeding in girls, hemarthrosis, etc. In clinical practice, it is advisable to distinguish several types of bleeding.

1. In the hematoma type, painful extensive hemorrhages are determined in the subcutaneous tissue, under the aponeuroses, in the serous membranes, in the muscles and joints, usually after injuries with the development of deforming arthrosis, contractures, and pathological fractures. There are prolonged, profuse post-traumatic and postoperative bleeding, less often - spontaneous. The late nature of bleeding is expressed, that is, several hours after the injury. The hematoma type is characteristic of hemophilia A and B (deficiency of factors VIII and IX).

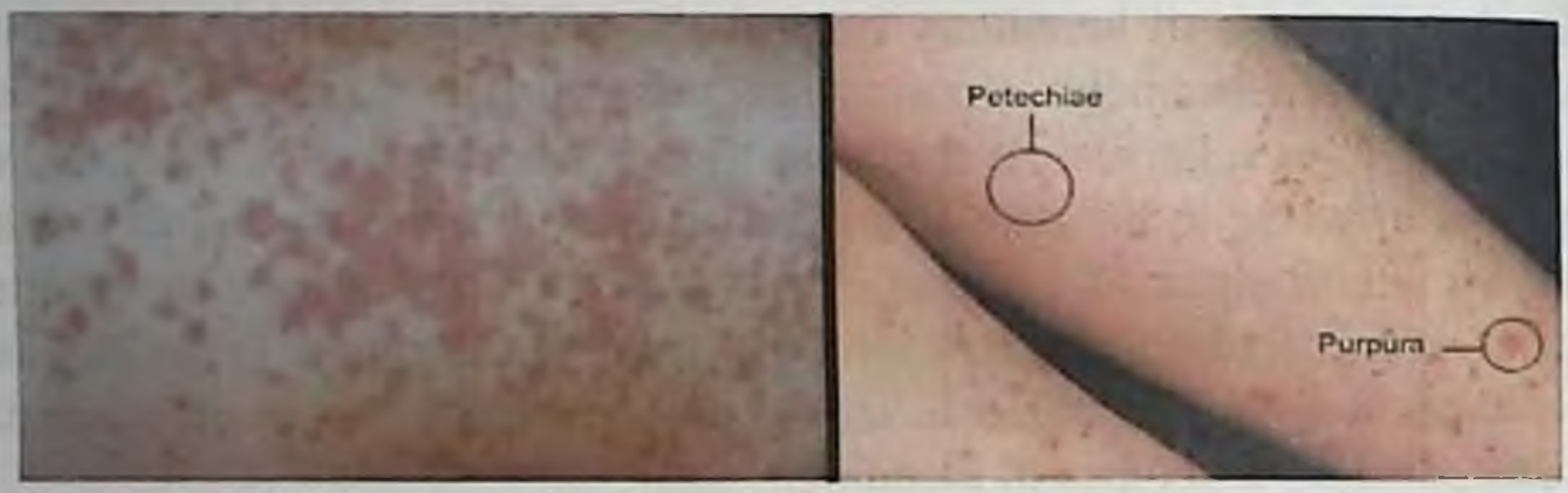


Picture 35. Hematoma

Petechial-spotted (bruising), or microcirculatory, type is characterized by petechiae, ecchymosis on the skin and mucous membranes, spontaneous (occurring mainly at night with asymmetrical hemorrhages in the skin and mucous membranes) or bleeding that occurs with the slightest injury: nasal, gingival, uterine, renal. Hematomas are

rarely formed, the musculoskeletal system does not suffer. Postoperative bleeding is not observed (except for tonsillectomy). Frequent and dangerous hemorrhages in the brain; as a rule, they are preceded by petechial hemorrhages in the skin and mucous membranes.

The microcirculatory type is observed with thrombocytopenia and thrombocytopathies, with hypo- and dysfibrinogenemia, deficiency of factors X, V and II.



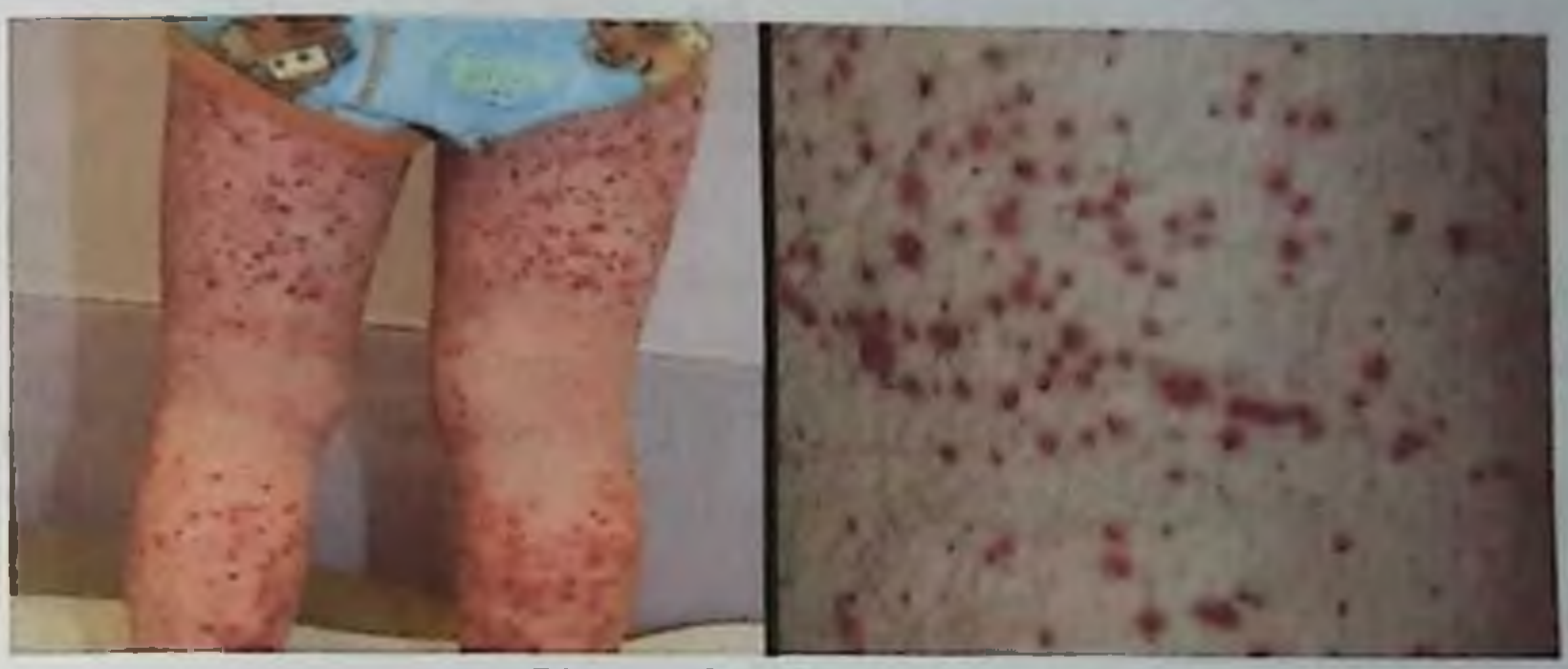
Picture 36. Petechiae and purpura

3. The mixed (microcirculatory-hematoma) type is characterized by a combination of the above two forms and some features; the microcirculatory type predominates, and the hematoma type is slightly expressed (hemorrhages mainly in the subcutaneous tissue). Hemorrhages in the joints are rare. This type of bleeding is observed in von Willebrand disease and von Willebrand-Jurgens syndrome since the deficiency of coagulant activity of plasma factors (VIII, IX, VIII + V, VII, XIII) is combined with platelet dysfunction. Of the acquired forms, this type of bleeding may be due to a deficiency of prothrombin complex factors and factor XIII, DIC, an overdose of anticoagulants and thrombolytics, and the appearance of immune inhibitors of factors XIII and IV in the blood.

4. The vasculitic-purple type is caused by exudative-inflammatory phenomena in microvessels against the background of immune allergic and infectious-toxic disorders. The most common disease in this group is hemorrhagic vasculitis (Schonlein-Henoch syndrome).

The hemorrhagic syndrome is represented by symmetrically located, mainly on the extremities in the region of large joints, elements demarcated from healthy skin, protruding above its surface, represented by papules, blisters, vesicles, which may be accompanied by necrosis and crusting. There may be an undulating course, "blooming" of elements from purple to yellow, followed by fine peeling of the skin.

With the vasculitic-purple type, abdominal crises are possible with heavy bleeding, vomiting, macro-, and microhematuria (more often), often transforming into DIC.



Picture 37. Hemorrhages

5. The angiomatous type is characteristic of various forms of telangiectasia in angiomas, arteriovenous shunts. The most common type is Osler-Rendu syndrome.

VERIFICATION QUESTIONS

1. At which age in childhood the hematocrit has the lowest normal level?

A. 3 months
B. 1 hour
C. 1 week
D. 1 month

2. In differentiating hemophilia from vitamin K deficiency, the most usefullaboratory test is:

A. prothrombin time
B. platelet count
C. fibrinogen concentration
D. bleeding time

3. Percussion over the spleen normally elicits which sound?

A. Dullness
B. Tympany
C. Resonance
D. Hyperresonance

4. Where should the physician palpate to assess the posterior cervical lymphnodes?

A. Along the anterior surface of the trapezius muscle
B. Along the anterior surface of the sternocleidomastoid muscle
C. Along the posterior surface of the scalene muscle
D. Along the posterior surface of the trapezius muscle
5. Hemolysis may be characterized by:
A. all of the above
B. shortened RBC life span
C. accelerated RBC destruction
D. increased reticulocyte count if the marrow is not suppressed
6. Tiny, flat, round, red or purple spot on skin caused by minute submucosal orintradermal hemorrhage is:
A. Petechia
B. Ecchymosis
C. Purpura
D. Macula
7. Lymphocytosis is associated with:
A. Pertussis
B. myocardial infarction (MI)
C. infection
D. tissue necrosis from burns
8. The microcytic anemia is associated with:
A. iron deficiency
B. hemolytic disorders
C. folic acid deficiency
D. due to toxins
9. Which test would confirm a clotting disorder?
A. platelet count
B. bone marrow aspiration
C. erythrocyte fragility
D. leukocyte count
10. The microcytic anemia is associated with:
A. iron deficiency
B. hemolytic disorders
C. folic acid deficiency
D. due to toxins

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