POLTAVA STATE MEDICAL UNIVERSITY

# NEWBORN BABY. PHYSIOLOGICAL AND TRANSIENT CONDITIONS IN NEWBORNS. PREMATURE NEONATES. THE CONCEPT OF MATURITY.

Lecture N1
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# Plan of the lecture

- 1. Definition of  antenatal stage of the childhood .
- 2. Periods of postnatal stage of childhood and their characteristics.
- 3. Classifications of the newborns. WHO criteria of live-born fetus.
- 4. External and functional attributes of maturity.
- 5. The main peculiarities of newborn’s systems .
- 6. Transitory conditions in a newborn.
- 7. Morphological (external) and functional attributes of prematurity.
- 8. Apgar Score of the newborn.

# Intrauterine, antenatal stage

**270 days from fertilization, or 40 weeks starting from the first day of last menstrual cycle**

- **Germinal period – 1 week from fertilization**
- **Implantation – about 40 hours**
- ***Embrional* period – till 7 weeks of pregnancy**
- **Embriofetal period - 7-8 weeks**
- **Early *fetal* period – from 9 to 28 weeks**
- **Late *fetal* period – from 29 week up to delivery**
- **Intranatal period – from the beginning of delivery up to a cutting of umbilical cord**

# Extratrauterine, postnatal stage

- Neonatal period:
- A) Early neonatal - 0-7 days
- B) Late neonatal – 8-28 days
- Breast (infancy) period – 29 days – 1 year
- Prepreschool period (toddler) - 1-3 years
- Preschool period - 4-6 years
- Junior school period - 7-11 years - prepubescent
- Senior school period – 12-18 years – pubescent and postpubescent

# Teratogens

**Exogenous teratogens:**

- **physical factors – ionizing radiation, electromagnetic fields;**
- **chemical – industrial, household chemical goods and agricultural toxins, medicines, nicotine, alcohol, drugs;**
- **infectious – flu, enteroviral infection, viral hepatitis, toxoplasmosis, rubella, cytomegalic inclusion disease, herpes;**
- **nutritional deficiencies of folic acid, copper, iron, zinc**

- **Endogenous:**
  - genetic mutations and aberrations
- **Combined:**
  - manifestation of some genetic diseases is possible only at the presence nutritional deficiency;

# Neonatal period

- **During *neonatal period* processes of adaptation to new conditions of existence, transition to a lung respiration and enteral feeding occurs.**
- **The resistance of an organism is low; it is marked predilection to a generalization of infections – septic diseases.**
- **The nervous system is underdeveloped; processes of inhibition dominate.**

# Neonatal period

- following physiologic and pathologic conditions are characteristic:
  - physiological or transient conditions (physiological catarrh of skin, transient body mass loss , transient hyperbilirubinemia, hormonal crisis, uric acid infarction of kidneys, etc.)
  - anomalies of development, fetopathies, hereditary diseases;
  - intra-uterine infections;

# Neonatal period

- birth trauma, hypoxic and traumatic lesion of CNS, cerebral palsy;
- respiratory distress, an asphyxia;
- neonatal hemolytic disease;
- purulent - septic diseases, pyodermia, umbilical sepsis;
- bacterial and viral diseases of respiratory system and gastrointestinal tract

# TERMS: According to gestational age

- Full term infant: An infant born at a gestational age between 37 and 42 completed weeks

- Preterm infant: An infant that is born prior to 37 weeks of gestation (22 -37 weeks or weight greater than 500g).

- Post-term infant: An infant that is born after the 42nd week of gestation

# WHO criteria of live-born fetus

- Viable newborn has duration of gestation 22 and more weeks, mass not less than 500 g.
- Live-born is viable neonate with 1 or more attributes of live. They are respiration, heart sounds and pulsation of an umbilical cord.
- Dead (still)-born is viable child who doesn't have any attributes of life
- Abortion is a birth of fetus before 22 weeks, with mass less than 500 g. If this newborn has survived 168 hours (7 day), he may be concern to live-born but extremely immature.

# External attributes of maturity

- Skin is pink.
- Lanugo (germinal down) is kept only on the upper part of back and on the shoulders.
- Length of head hair is 2-3 cm.
- Nasal and ear cartilages and nails are dense.
- Nails reach up to end of fingers.
- Umbilical cord is in the middle of the body.
- Testicles are lowered in a scrotum; girls' labia majora pudendi are cover labia minora.

# Functional attributes of maturity

- Ability to keeping constant body temperature.
- Rather right rhythm of respiration and cardiac tones without cases of apnea and cyanosis.
- Active suction, absence of the expressed regurgitation.
- Sufficient mobility (uncoordinated movements).
- Physiological hypertensions of flexor muscles (embryonal position).
- Loud emotional cry, presence of reaction on bright light, sounds, manipulations.
- Presents (expressiveness) of unconditioned reflexes.

# The main peculiarities of newborn's systems

# Nervous system. Transitory reflexes of newborns

- Oral automatism: sucking, trunk (lip), search, Babkin's palm-mouth reflex.
- Spinal reflexes: grasping, Robinson's tonic reflex of hands, Moro's reflex, reflex of support, crawling  Bauer's reflex, reflex of stepping automatism, Kerning's, Babinski's, Perez's, Gallant's.

# Permanent reflexes

- Swallowing
- Papillary
- Conjunctival
- Tendon
- Corneal

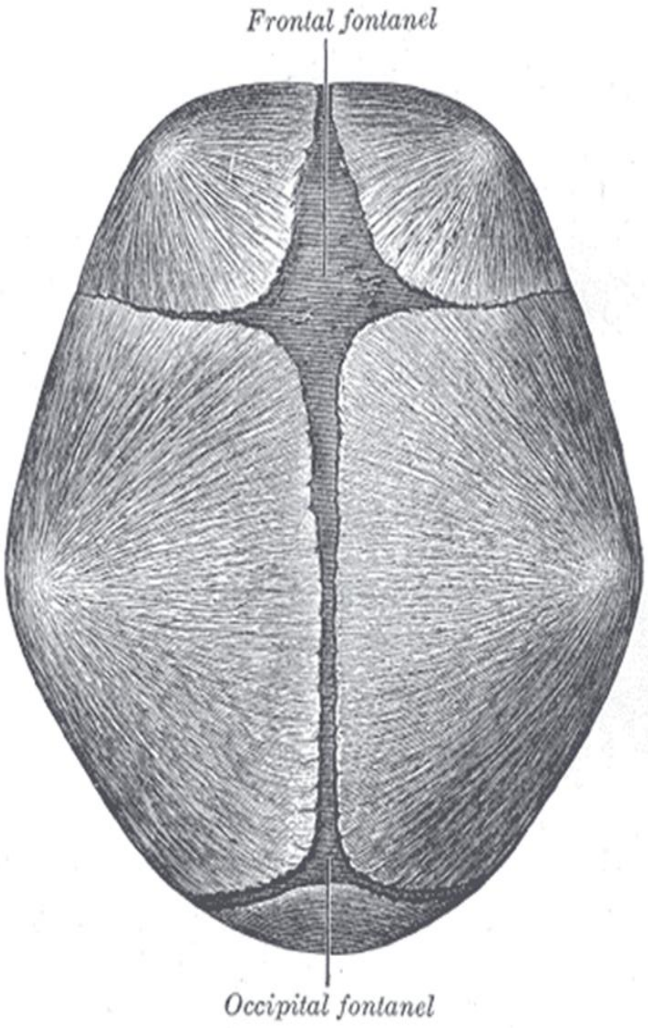
# Fontanelles

- The anterior fontanel is located at the intersection of the sutures of the two parietal bones and the frontal bones.

Anterior: diamond shape about 2-3-4 cm, will close in about 12 to 18 months;

- The posterior fontanel is located between of the sutures of the 2 parietal bones and occipital bone.

It is small, triangular shaped, normally closes at 1,5 to 3 months of age.



# Respiratory system

- Transition to pulmonary respiration
- Respiration is superficial, arrhythmic, in auscultation is diminished vesicular (weakness of respiratory muscles).
- Tachypnea 40-60 in 1 minute
- Chest is wide, short. The ribs are located almost horizontally. A type of respiration is diaphragmatic.

# Cardiovascular system

- The pulmonary circulation begins
- Umbilical vessels, venous and arterial ducts, and the oval window close.
- The size of newborn’s heart is relatively bigger, than in adult.
- Cardiac rate is 140-160 per one minute;
- Blood pressure is lower, 75-76 mm of hg.

# Digestive system

- The digestive tract is sterile, and colonization by bacteria begins.
- In the first day meconium appears (first-born excrement like dark green mass, consisting of an epithelium, cholic pigments, slime and swallowing amniotic fluid).
- The liver is relatively bigger; it is palpated 2-3 cm lower the right hypochondria


# Meconium

- Green–black stool passed by babies in the first days after birth
- Fresh meconium-stained liquor can be a sign of fetal distress

# Urinary system

- physiological oliguria or anuria in the first day.
- amount of urine is 5-50 ml a day, relative density of urine is 1008-1013
- on 5 day quantity of urine increases, and the relative density reduces up to 1002-1004.

The eyes of most infants are puffy and blue, adult color usually develops by six months of age.

# Hair

Some babies are born with a thick head of hair, while others may have a thin crop or be practically bald. All baby hair gradually falls out and is replaced with a new growth.

# Lanugo.

An infant's thin, downy body hair is called lanugo. This growth is usually shed in utero during the ninth month of pregnancy. Some lanugo may remain on the shoulders, back, forehead, and temple after birth but these patches are shed during the first week of life.

# Transitory conditions in a newborn.

- States that reflect the process of adaptation to new conditions of life are called transitory (border, transitional, physiological).
- Borderline these conditions are called because they arise on the border of two periods of life (intrauterine and extrauterine) and under certain conditions can acquire pathological features, leading to disease.

# Transitional states of newborns – adaptation to new conditions of live

# #1 Physiologic weight loss

- it is normal for the newborn infant to loose 5-10% of weight in the first 4 to 5 days of life
- Causes: low nutritional

intake, defecation,

urination);

# Transitional loss of initial mass of body

- usually no more than 6% - 1 degree,

  6-10% - 2 degree, >10% - 3 degree
- Reasons - hanger, perspiration, respiration, urination, discharge of meconium
- *Appears on 3-5 day, restores on 7-10 day (ideal) or 14 day (slowed)*

# Transitional violation of thermal balance:

- transitional hypothermia (*first 30 min, restores on 2$^{nd}$ day)*
- transitional hyperthermia (*on 3-5 day, duration up 2 weeks)* – dehydratation, immaturity of thermoregulation

# Transitional changes of skin:

- simple erythema (physiological catarrh of skin, hyperemia) – *from 2nd day to 1 week*
- toxic erythema (papulovesicular eruptionon on unbending surfaces, around the joints, on buttocks and chest )– paraallergic reactions - *from 2nd day to 1 week*
- Transitional hyperbilirubinemia and physiological jaundice - *from 2-3 day to 2 weeks* – erythrocytolysis and immature of hepatocytes

# Physiologic Jaundice

- - after 24-48 hs of age, d/t  increased breakdown of RBC’s and immature liver functioning.
- lasting until day 8 in term births, or to around day 14 in premature births.
- This is a yellow discoloration that may be seen in the infant's skin or in the sclera of the eye.
- Jaundice is caused by excessive amounts of free bilirubin in the blood and tissue.

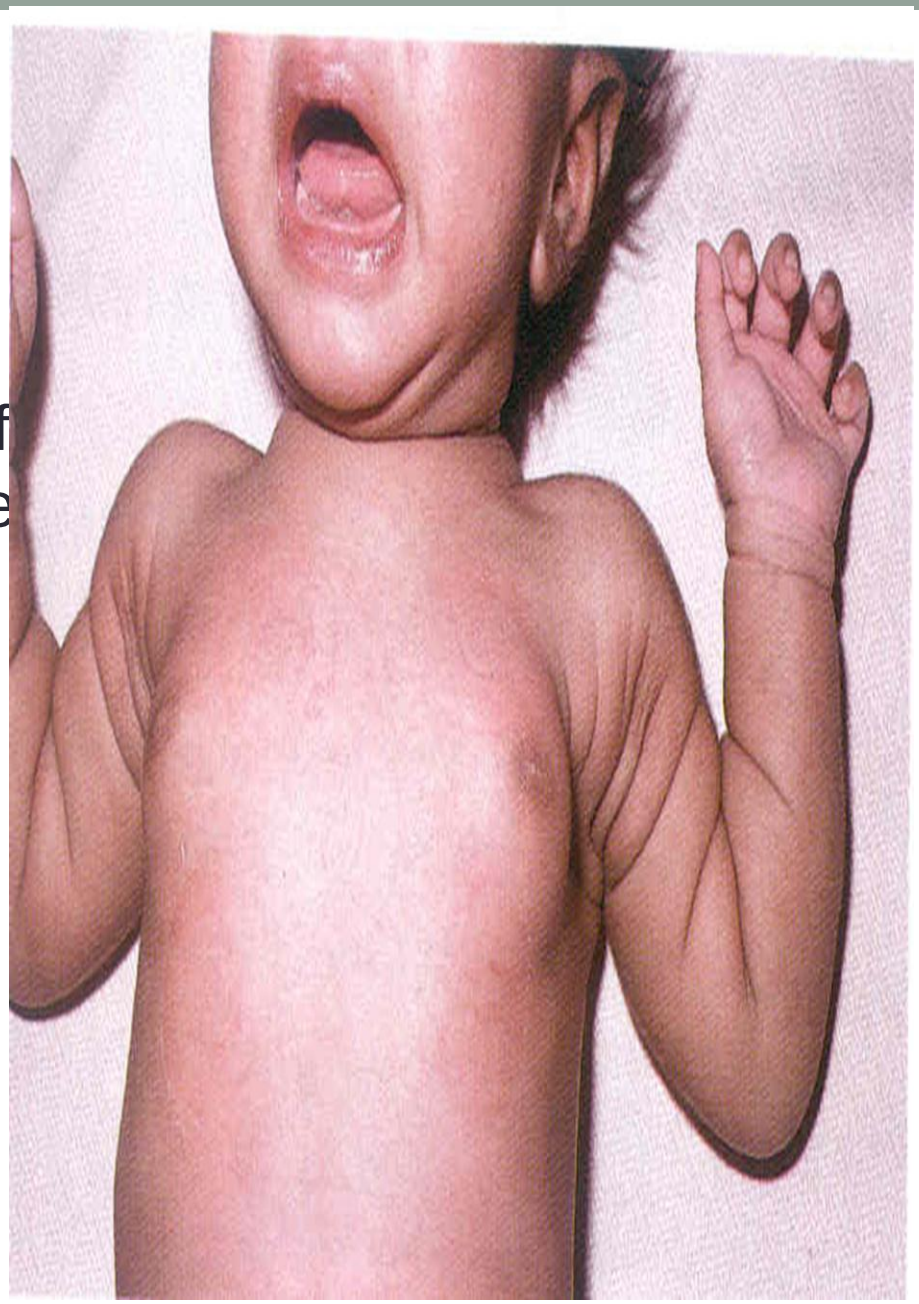
# Hormonal crisis:

*(first week)*

- physiological mastopathy (augmentation of mamary glands, secretion of colostrum)
- desquamattive vulvovaginitis
- metrorrhagia
- Milia (white acne on the nose and chicks)

# Sexual crisis

- Enlargement of the breasts and production of milk may occur at the age of 3 to 5 days in some newborn boys or girls. This stops at the postnatal age of 2 to 3 weeks.
- This is also caused by transmission and withdraw of maternal hormones. This no requires management.



# Transitional features of function of kidneys:

*First 3 days*

- transitory oliguria
- transitory proteinuria
- glucosuria
- uric acid infarction of kidneys

**Transitional dysbacteriosis** – *first week* - physiological dyspepsia arises in all newborns as a result of colonization of sterile newborn's intestine by normal microflora.

# Transitional states can be:

- Physiological - take place in most neonates. It is the norm.
- Borderline - meet not at all newborns and much closer to pathology. They do not demand treatment, but orient the doctor on carrying out some preventive actions.

# Borderline conditions

- transitional hyperthermia,
- toxic erythema,
- uric acid infarction of kidneys
- loss of initial mass of body more than 6% (2-3 degrees)

# Erythema Toxicum Neonatorum

Onset in the second to the third day of life, mostly in term babies of lesions characterized by the whitish to yellowish papule surrounded by a halo of erythema, mainly over the trunk but also in the limbs and face.

# Premature child

- the child who has been born between 22 and 37 weeks of pregnancy
- mass of body less then 2500 g
- length less then 45 cm
- 5-10 % of all newborns are  premature

# Clinical classification of newborns based on the birth weight

- Low-birth-weight (LBW) infants
  **< 2500 g**
- Very-low-birth-weight (VLBW) infants
  **< 1500 g**
- Extremely low-birth-weight (ELBW) infants
  **1000 g**

<

# The reasons of prematurity

- infectious diseases during pregnancy: a rubella, a cytomegaly, a HIV – infection, other infections transmitted in the sexual way
- the burdened current of pregnancy: toxicoses, a wrong position of a fetus, a multiple pregnancy
- endocrine and somatopathies of mother
- chronic inflammatory diseases of mother’s pelvic organs

# The reasons of prematurity

- anomalies of a structure of genitals, traumas and cicatrices on a uterus
- immune incompatibility of mother and fetus, for example, on a Rh factor
- social and economic, and also physical (radiation), chemical (medicinal substances, narcotics, alcohol), the nutritional reasons
- stressful situations

# Morphological (external) attributes of prematurity

- disproportional body building, a head rather big, a cerebral skull sharply prevails above facial, extremities and a neck are short, the umbilical ring is displaced to a pubic area
- skull is spherical, its bones are soft, pliable, seams and a small fontanel are open
- auricles are soft and close adjoin to a head

# Morphological (external) attributes of prematurity

- skin is thin,  lanugo is not only on a back and brachium, but also on a forehead, cheeks and hips
- the subcutaneous fatty layer is thin, it is kept only in the field of cheeks (Beesh's fatty lumps)
- nail plates are soft, nails do not reach up to end of fingers
- labia major in girls do not cover labia minor, in boys testicles are not lowered in a scrotum

# Functional attributes of immaturity

- flaccidity, sleepiness, weak cry, hypotonus of muscles, lower sucking and swallowing reflexes, violation of  thermoregulation
- superficial, spasmodic respiration, pathological types of respiration, attacks of apnea
- tachycardia up to 200 in one minute, embriocardia (equal intervals between 1 and 2 tone), low arterial pressure
- pathologic vascular tone: underlying part of a trunk is pink, and top part is white – Finkelstein's sign

# Features of adaptation of premature childen

- transitional loss of mass of body is more expressed,  on 9-14 %, restores later, in 2-3 week
- hyperbilirubinemia is more expressed, lasts till 3 weeks
- physiological erythema is brighter and longer, but peeling is absent
- toxic erythema, transitional hyperthermia, hormonal crisis and uric acid infarction of kidneys in premature meet seldom and have the erased clinic

The Apgar score rates:

Respiration, crying

Reflexes, irritability

Pulse, heart rate

Skin color of body and extremities

Muscle tone

A.D.A.M.

# Apgar Score of the Newborn

| SIGNSCORE | 0 | 1 | 2 |
|---|---|---|---|
| **Heart rate** | Absent | <100 beats/min | >100 beats/min |
| **Respiratory effort** | Absent | Weak, irregular | Strong cry |
| **Muscle tone** | Flaccid | Some flexion | Well |
| **Reflex irritability (response to catheter in nostril)** | No | Grimace | Cough or sneeze |
| **Skin colour** | Blue, pale | extremities blue | pink |

# The Apgar score is used to evaluate

- which babies need active assistance (resuscitation)
- evaluate the conditions of the baby at birth,
- determine the need for resuscitation,
- to identify neonates at risk for morbidity and mortality.
- circulatory status at birth
- the effectiveness of respiratory and circulatory adaptations thereafter

# Estimation on Apgar score

- One estimate the general condition and presents of asphyxia in newborn by Apgar score at the first and 5th minutes after birth
- 7-10 - satisfactory general condition, an asphyxia is absent
- 6-4 – moderate asphyxia
- less then 4 – severe asphyxia
- 0 – clinical death


thankyouforyouratt

# Literature, was used in the lecture


- 1.Nelson Textbook of Pediatrics: 21th edition / Klegman S, Geme ST, Tasker W, 2021. – 1078 p. 2. Основи педіатрії за Нельсоном: переклад 8-го англ. видання : у 2 томах. Том 1 / Карен Дж. Маркданте, Роберт М. Клігман. – К.: ВСВ «Медицина», 2019. – XIV, 378 с. 3.Пропедевтична педіатрія : підручник для студентів вищих медичних навчальних закладів IV рівня акредитації / В. Г. Майданник [та ін.]. - 2-ге вид., випр. та допов. - Вінниця : Нова кн., 2018. - 871 с. : табл., іл. . 4. Henderson G, Anthony M, Quigley M. Formula milk versus term human milk for feeding preterm or low birth weight infants. Cochrane Database of Systemic Reviews . 2020; 77(6):1537S-43. 5. Elwyn DH, Askanazi J, Kinney JM, Gump FE. Kinetics of energy substrates. Ada Chir Scand Suppl 2019;507:209-19. 6. Talpers SS, Romberger DJ, Bunce SB, Pingleton SK. Nutritionally associated increased carbon dioxide production. Excess total calories vs high proportion of carbohydrate calories. Chest 2019;102(2):551-5.7. Askanazi J, Weissman C, LaSala PA, Milic-Emili J, Kinney JM. Effect of protein intake on ventilatory drive. Anesthesiology 2019;60(2):106—10. 8. Klein CJ, Stanek GS, Wiles 3rd CE. Overfeeding macronutrients to critically ill adults: metabolic complications. J Am Diet Assoc 2019;98(7):795-806. 9. Pineault M, Chessex P, Bisaillon S, Brisson G. Total parenteral nutrition in the newborn: impact of the quality of infused energy on nitrogen metabolism. Am J Clin Nutr 2019;47(2):298-304. 10. Koletzko B, Goulet O, Hunt J, Krohn K Shamir R, Parenteral Nutrition Guide¬lines Working G, et al. Guidelines on Paediatric Parenteral Nutrition of the European Society of Paediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN) and the European Society for Clinical Nutrition and Metabolism (ESPEN), supported by the European Society of Paediatric Research (ESPR). J Pediatr Gastroenterol Nutr 2020;41(Suppl. 2):Sl-87. 11. Rodriguez JL, Askanazi J, Weissman C, Hensle TW, Rosenbaum SH, Kinney JM. Ventilatory and metabolic effects of glucose infusions. Chest 2118;88(4): 512-8. 12. Extracorporeal Life Support Organization (ELSO). ELSO Guidelines for Neonatal Respiratory Failure Supplement to the ELSO General Guidelines. 2018 Dec [cited 2018 Jun 22]; 13. The Neonatal Inhaled Nitric Oxide Study Group. Inhaled nitric oxide in full-term and nearly full-term infants with hypoxic respiratory failure. N Engl J Med. 2018;336(9):597–604. Robertson C, Sokol GM, Solimano A, Singer J, et al. Early Inhaled Nitric Oxide Therapy for Term and Near Term Newborn Infants with Hypoxic Respiratory Failure: Neurodevelopmental Follow-Up. J Pediatr. 2017 Mar;150(3):235–240.e1.
- **Інтернет – ресурси:**
- Сайти МОЗ України: https://moz.gov.ua/protokoli Онлайн-платформа з протоколами на засадах доказової медицини Джерела клінічних настанов Інформаційні ресурси http://www.booksmed.com/pediatriya http://pediatriya.info http://health-ua.com/parts/pediatrics http://www.med-edu.ru/pediatr http://medi.ru/Doc/j01.htm http://www.mif-ua.com/archive/zhurnal-zdoroverebenka/numbers,http://www.medport.info/index.php?option=com_content&view=section&id=48&Itemid=73 http://youalib.com/медицина/педіатрія