

The algorithm of neurological examination of a newborn

according to the “Clinical protocol of medical care for a healthy child under 3 years of age” (order of the Ministry of Health of Ukraine dated March 20, 2008 No.149) and “Protocol of medical care for a healthy newborn child” (order of the Ministry of Health of Ukraine dated April 04, 2005 No.152)

	Actions	Normal reaction, that should be commented
1.	1) Wear gloves (without gloves, you will not be allowed to pass the exam!) 2) Greet the mother 3) Explain, what you are going to do	- Good afternoon - Now I will evaluate the nervous system state and primitive reflexes in your baby
	Evaluation of the child's activity and behavior	
2.	Ask the mother: How long does the baby usually sleep /stay awake?	- The baby sleeps between feedings and wakes up when hungry
3.	Ask the mother: Is the baby calm, excited or sluggish?	- The baby is calm after feeding
4.	Ask the mother: Is it easy to calm the baby when it cries?	- If the baby starts to cry it is easy to calm him/her
	Checking the muscle tone of the baby lying on his back	
5.	1) Remove the nappy 2) Check baby's muscle tone by looking at its limbs	- Lower limbs are flexed, that is, increased flexor muscles tone - The baby moves its limbs actively - The muscle tone is sufficient
	Checking primitive reflexes in a child in the supine position	
	Rooting Reflex	
6.	Check the rooting reflex: 1) touch a finger to the baby's right corner of mouth 2) touch a finger to the baby's left corner of mouth	- Both corners of the mouth go down when you touch - The baby turns the head toward the stimulus. Rooting reflex is lively and symmetrical
	Snout (Lip) Reflex	
7.	Check the snout reflex: 1) gentle tap baby's lips near the midline	- You can observe pouting or pursing of baby's lips - Snout reflex is elicited
	Hand-mouth (Babkin) Reflex	
8.	Check the hand-mouth (Babkin) reflex: 1) by your fingers (thumbs) symmetrically press to both baby's palms (to the ball of the thumb)	Baby: - opens its mouth; - flexes its head; - bends arms (shoulders and forearms). - The hand-mouth (Babkin) reflex is elicited
	Palmar Grasp Reflex	
9.	Check the grasp reflex: 1) put your index fingers into baby's palms	- Baby's fingers will reflexively grasp doctor's index fingers - Palmar grasp reflex is lively and symmetrical
	Moro Reflex	
10.	Check the Moro reflex: 1) Hit your palm on the table surface, where the baby is lying	You can observe: - symmetrical abduction of baby's arms at the shoulder and extension of arms at the elbow, with opening up of hand and curved fingers - followed by adduction of the arms and flexion of the forearm (i.e. an “embrace”). - Moro reflex is lively and symmetrical
	Checking primitive reflexes in a child holded under the shoulders in an upright position with his back to the doctor	

11.	1) Turn the baby to the side 2) Lift the baby with both your hands under his shoulders with his back to yours so that four fingers of both your hands cover baby's chest in front and the thumbs support baby's head from the back / sides 3) Lift the baby in an upright position	<i>I'm starting to check primitive support and stepping reflexes*</i>
	Support Reflex	
12.	Check the support reflex: 1) touch a table surface with baby's feet	Baby: - first pulls both legs away from the surface; - then tucks legs under; - then straightens the legs pressing by them on the table surface. - Support reflex is lively and symmetrical
	Stepping (automatic walking) Reflex	
13.	Check the stepping reflex: 1) touch a flat surface with baby's one foot 2) tilt its torso forward	- Baby takes steps on the table surface - Stepping reflex is elicited
	Checking primitive reflexes in a child lying on the abdomen	
14.	Place the baby on abdomen	<i>I'm starting to check the protective and crawling reflexes*</i>
	Protective reflex	
15.	Check the protective reflex: 1) evaluate the position of the head of the baby lying on abdomen	Baby: - turns its head to the side; - tries to lift it. - Protective reflex is elicited
	Crawling Reflex	
16.	Check the crawling reflex: 1) lightly press with your palm on the baby's soles 2) check what the baby is doing	- The child is actively moving (crawling) forward with the inclusion of hands and feet - Crawling reflex is elicited
17.	Make a conclusion	- Everything is good, baby is active - All reflexes are initiated well
18.	Finish the examination 1) Put on the nappy (diaper) 2) Thank the mother 3) Ask if she has any questions	- Thank you! - Do you have any questions?

Note:* not necessarily to say

Algorithm

Of assessment of blood pressure (BP) of a child using tables of centile distribution of blood pressure indicators depending on gender, age and centile assessment of growth

approved on meeting of propaedeutics of pediatrics department

Odessa national medical university

№	Actions	Possible options for assessing anthropometric indicators:			
	Assessment of height using centile charts				
1.	Choose a centile chart to measure your baby’s height based on gender and age				
2.	On the chart, indicate the point of intersection between the indicators of the child's age (vertical line) and his height (horizontal line).				
3.	Define the line (curve) or “track” between the lines (curves) where the intersection point of height and age is. Comment the result	5 centile	10 centile	25 centile	50 centile
		75 centile	90 centile	95 centile	
	Assessment of blood pressure by centile table taking into account age gender and centile growth assessment *				
4.	Select a chart to evaluate your baby’s blood pressure based on gender, age and centile height				
	Assessment of systolic BP				
5.	Find between which centiles the baby's systolic blood pressure is based on its centile in height				
6.	Comment the result of the assessment of systolic blood pressure (SBP) depending on centile by height	<90 centile		≥90 < 95-ro centile	
		BP ≥ 95-ro < (95-ro centile + 12 mmHg) OR 130 /80 – 139 /89 mmHg		BP ≥ (95-ro centile + 12 mmHg) OR ≥ 140 / 90 mmHg	
7.	Evaluate the result and comment the assessment of the SBP	Normal BP		Elevated BP	
		Stage I HTN		Stage II HTN	
	Assessment of diastolic BP (DBP)				
8.	Find between which centiles the baby's diastolic blood pressure is based on its centile in height				
9.	Comment the result of the assessment of diastolic blood pressure (SBP) depending on centile by height	<90 centile		≥90 < 95-ro centile	
		BP ≥ 95-ro < (95-ro centile + 12 mmHg) OR 130 /80 – 139 /89 mmHg		BP ≥ (95-ro centile + 12 mmHg) OR ≥ 140 / 90 mmHg	
10.	Evaluate the result and comment the assessment of the DBP	Normal BP		Elevated BP	
		Stage I HTN		Stage II HTN	
11.	Make the conclusion and comment it	For example: - - Blood pressure is normal OR - Systolic and diastolic blood pressure are elevated			

* ANNEX. https://www.cdc.gov/growthcharts/clinical_charts.htm
https://www.nhlbi.nih.gov/files/docs/guidelines/child_tbl.pdf

TABLE Updated Definitions of BP Categories and Stages

	For Children Aged 1–13 years	Children aged >13 years
Normal BP	BP < 90 th centile	BP < 120/80 mmHg.
Elevated BP	BP ≥ 90 th < 95 th centile	BP 120/80 – 129 /80 mmHg
Stage I HTN	BP ≥ 95 th <95 th centile + 12 mmHg OR 130 /80 – 139 /89 mmHg	BP 130 /80 – 139 /89 mmHg
Stage II HTN	BP ≥ 95 th centile + 12 mmHg OR ≥ 140 / 90 mmHg	BP ≥ 140 / 90 mmHg

Complete blood count assessment algorithm in children,
approved on meeting of propaedeutics of pediatrics department
Odessa national medical university

	Actions	Possible evaluation options		
	Using appropriate terms, say the result of the complete blood count and white blood differential assessment			
1.	1) Greet the mother 2) Explain what you are going to do	- Good afternoon - Now I'm going to assess your child's complete blood count test		
2.	Determine child's age and sex and assess the complete blood count according to child's age and sex*	- Child's age ____ months / years - Boy / girl		
	Assessment of red blood cells (RBC)			
3.	Evaluate RBC count	Anemia (erythropenia)	Normal	Erythrocytosis
4.	1) Evaluate haemoglobin concentration 2) If present, assess the severity of anemia	Anemia: - Mild (I) - Moderate (II) - Severe (III)	Normal	Elevated
5.	Evaluate colour index	Hypochromia	Normochromia	Hyperchromia
6.	Define <i>bone marrow regenerative</i> activity according to <i>reticulocyte count</i>	Hypoplastic anemia	Normal activity	Anemia with high reticulocyte count
	Interpretation of erythrocyte sedimentation rate (ESR)			
7	Evaluate ESR	-	Normal	Elevated
	Assessment of platelet concentration			
8.	Evaluate platelet concentration	Thrombocytopenia	Normal	Thrombocytosis
	Assessment of white blood cells (WBC)			
9.	Evaluate WBC count	Leukopenia	Normal	Leukocytosis
	Assessment of WBC differential			
10	Assess the presence and relative content of young leukocyte forms	-	Normal	- Left shift - The presence of blast cells
11	Assess the relative content of leukocytes in the WBC differential	Relative: - neutropenia - lymphopenia	Age-appropriate (normal)	Relative: - neutrophilia - lymphocytosis - eosinophilia - monocytosis
12	Describe detected hematologic syndromes	<i>For example: There are changes in the blood test:</i> - Anemia, probably with iron deficiency OR - Thrombocytopenia OR - Infectious-inflammatory syndrome		
13	Thank the mother			

***Annex (Addition).**

Normal lab values in children

1. Normal complete blood count values in children of different age

Analyte	Age						
	1 day	4–5 days	6 months	1 year	4–5 years	6–12 years	>12 years
Hb g/L	180-240	150-200	110-140	110-140	115-140	115-140	B-130-160 G-120-140
RBC x 10¹²/L	4,5-7,5	4,0-6,5	3,9–5,3	3,9–5,3	3,9–5,3	3,9–5,3	B - 4,0–5,0 G -3,9–4,7
MCHC %	0,85-1,15	0,85-1,15	0,85-1,15	0,85-1,15	0,85-1,15	0,85-1,15	0,85-1,15
RTC ‰	5–50	5–50	5–20	5–20	5–20	5–20	5–20
PLT x 10⁹/L	180-490	180-490	180-400	180-400	160-390	160-350	160-320
ESR mm/h	2-4	2-4	4-10	4-12	4-12	4-12	8-12
WBC x 10⁹/L	9-30	9-14	6-13	5-12	5-12	4-10	4-9,5
Band neutrophils %	1-10	1-5	1-5	1-5	1-5	1-5	1-4
Segmented neutrophils %	45-80	35-55(45)	20–40	20-40	35-55(45)	40-60	40-60
EOS %	1-5	1-5	1-5	1-5	1-5	1-5	1-5
BAS %	0-1	0-1	0-1	0-1	0-1	0-1	0-1
LYM %	15-35	35-55(45)	40-75	40-75	35-55(45)	30–45	30–45
MON %	2-10	2-10	2-10	2-10	2-10	2-10	2-10

2. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity (g/L) (WHO, 2011)

Age	Non-anemia	Anemia		
		Mild	Moderate	Severe
6 – 59 months	or higher	100 – 109	70 – 99	1
5 – 11 years	or higher	110 – 114	80 – 109	1
12 – 14 years	or higher	110 – 119	80 – 109	1
G i	or higher	110 – 119	80 – 109	1 o
Boys 15 years and older	or higher	110 – 129	80 – 109	1 o

Algorithm
of assessment of 24-hour urine specific gravity test in children
 approved on meeting of propaedeutics of pediatrics department
 Odessa national medical university

	Actions	Possible variants of assessment
	Comment the results of each indication in 24-hour specific gravity urine test using the appropriate terms	
1.	Greet the mother	Good afternoon
2.	Explain what you are going to do	Now I'm going to interpret the specific gravity urine test to evaluate your baby's kidney function
3.	Determine child's age and assess the indicators according to normal ranges depending on age*	- - Age of child ____ months / years - - Boy / Girl
4.	Calculate daytime diuresis (DD-1-4 samples) and record the result on the analysis form	
5.	Calculate nocturnal diuresis (ND - 5-8 samples) and record the result on the analysis form	
6.	Evaluate the ratio of daytime and nocturnal diuresis to determine if nocturia is present	- Normal ($DD > ND$) - Nocturia ($DD \leq ND$)
7.	Calculate 24-hour diuresis (DD + ND) and record the result on the analysis form	
8.	Calculate the percentage of urine excreted from the fluid intake (FI) using proportion: $FI - 100\%$ $24\text{-hour diuresis} - X\%$ $X = 24\text{-hour diuresis} \times 100 : FI$ Record the result on the analysis form	
9.	Assess whether the 24-hour diuresis is normal or not	- Norm - Polyuria
10.	If 24-hours diuresis is 500 ml or less, calculate diuresis per 1 kg of body weight per day (24-hour diuresis: body weight)	- Norm - Oliguria
11.	Record (underline) the lowest and highest urinary specific gravity	
12.	Assess fluctuations in the specific gravity of individual samples of urine	- Norm - Hypostenuria - Isostenuria - Hyperstenuria
13.	Indicate if changes in the kidney function are present	Detected: - Normal kidney function - Disturbed excretory function - Disturbed concentration function - Disturbed hormone synthesizing function
14.	Thank the mother and ask if she has any questions	- Thank you - Do you have any questions?

* ANNEX. Normal ranges of laboratory indicators in children

1. Indicators of 24-hour urine specific gravity test for children

1. Daily diuresis

- **Norm:**
 - Approximately 0.8 - 2.0 liters
 - 65-80% of the fluid intake per day
 - Significant fluctuations in the amount of urine during the day in individual samples 0 - 300 ml
- **Polyuria** - increase in 24-hour diuresis of more than 2.0 liters or more than 80% of the daily fluid intake
- **Oliguria** - 24-hour diuresis less than 500 ml or ≤ 12 ml / kg / 24-hours
- **Daytime diuresis (DD)** outweighs nighttime - approximately 2: 1 or 2/3 - 3/4 of 24-hour diuresis
- **Nocturia** - nocturnal diuresis equal to daytime diuresis (DD: ND = 1: 1) in children older than 2 years (up to 2 years is the norm) or nocturnal diuresis prevails on daytime diuresis (DD <ND) at any age - may be a sign of a violation concentration of kidney function

2. Specific gravity:

- **Normal concentrational function of kidney:**
 - fluctuations in specific gravity during the day within 1 008 - 1 025
- AND
 - at least in one sample the specific gravity should be not less than 1 018, in children under 5 years - not lower than 1 012
- **Isostenuria** - inability of the kidneys to produce concentrated and diluted urine - specific gravity of urine approximately the same as primary urine (about 1,010), fluctuations in all portions per day 1 009-1013
- **Hypostenuria** - urine specific gravity is constantly low with small fluctuations of 1 008 and below - is also a sign of impaired renal concentration, most often in diabetes mellitus
- **Hyperstenuria** – increased specific gravity of urine in all samples higher than 1 030 - the result of increased level of dense substances in the urine due to dehydration, or due to increased reabsorption of water in the renal tubules in vascular insufficiency, or due to increased glucose level in the urine

Algorithm
of urinalysis result assessment in children
 approved on meeting of propaedeutics of pediatrics department
 Odessa national medical university

	Actions	Possible variants of assessment
	Comment the result of each urinalysis test indicators using the appropriate terms	
1.	Greet the mother	
2.	Determine child's age and gender and assess child's indicators of urinalysis according to his/her age and gender *	
	Gross and chemical examination	
3.	Urine colour	- Light yellow - Dark brown - "Coca-cola"
4.	Assess the transparency of urine	- Transparent - Cloudy
5.	Assess the pH	- Neutral - Acidic - Alkaline
6.	Assess protein level	- Norm - Proteinuria
7.	Assess glucose level	- Norm - Glucosuria
8.	Assess the level of ketones	- Norm - Ketonuria
9.	Assess the nitrite level	- Norm - Nitrituria
	Microscopic examination	
10.	Assess the number of red blood cells	- Norm - Hematuria
11.	Assess the number of leucocytes	- Norm - Leucocyturia
12.	Assess the presence of the epithelium and its type	- Squamous epithelial cells few- norm - Transitional-pathological - Renal tubular-pathological
13.	Assess the presence of casts and its type	- Norm - Cylindruria: hyaline, granular, epithelial, erythrocytic, leukocyte, waxy
14.	Assess the presence of crystals and their appearance	- Norm - Crystaluria, Uraturia, Oxalaturia
15.	Assess the presence of bacterias	- Norm - Bacteriuria
16.	Make a conclusion about changes in the urinalysis and determine which clinical nephrological syndrome it represents	Example: - Urinary syndrome: leukocyturia, erythrocyturia, bacteriuria OR - Nephritic syndrome OR - Nephrotic syndrome
17.	Tell what kind of disease these changes are characteristic of	Example: - Urinary tract infection OR - Glomerulonephritis
18.	Thank the mother and ask if she has any questions	

*** ANNEX. Norms of laboratory indicators in children**

1.Indicators of urinalysis in children

pH	5,0-7,5
Protein	< 0,033 g/l
Glucose	Norm-absent
Ketones	Norm-absent
Bilirubin	Norm-absent
Nitrites	Norm-absent
Hemoglobin	Norm-absent
Erythrocytes	< 2 /hpf
Leucocytes	
- Boys	< 5 /hpf
- Girls	< 10 /hpf
Squamous epithelial cells	
- Girls	< 5 /hpf
- Boys	< 3 /hpf
Transitional epithelial cells	< 1 /hpf
Renal tubular epithelial cells	Norm-absent
Casts	Norm-absent
Bacteria	Norm-absent
Crystals	Norm-absent
Mucus	Norm-small amount

**Algorithm
for the clinical examination and evaluation of meningeal symptoms in children**

№	Actions	Possible variants of evaluating the meningeal symptoms you need to announce	
1	Greet the mother and explain what you are going to do	Good afternoon, now I'm going to examine the signs of meningeal irritation in your child	
		Meningeal symptoms	
		positive	negative (normal)
	Palpate a large fontanel		
2	Palpate a large fontanel in infant <u>commenting all your actions and results:</u> 1) palpate the large fontanel on the upper part of the head in the area bounded by two parietal and frontal bones	Positive symptom: bulging, tensed and pulsing large fontanel	Normal- negative symptom: a large fontanel at the level of skull bones, no tension and pulsation
3	To investigate the following symptoms, place the patient in supine position with legs <u>commenting all your actions</u>		
	Check for nuchal rigidity		
4	Check for nuchal rigidity <u>commenting all your actions and results:</u> 1) At one time: - slightly pressing, fix the chest of the child lying supine with your right (dominant) hand; - place the left hand under the child's head 2) try to flex head forward - towards the chest	Positive symptom: - pain - difficulty, and sometimes even impossibility, due to neck muscle tension (neck muscles rigidity)	Normal- negative symptom: flexion is free and painless
	Check The Brudziński neck sign		
5	Check The Brudziński neck sign <u>commenting all your actions and results:</u> 1) At one time: - slightly pressing, fix the chest of the child lying supine with your right (dominant) hand; - place the left hand under the child's head 2) try to flex head forward - towards the chest 3) look at child's legs	Positive symptom: forced ("protective") flexion of both hips and knees	Normal -negative symptom: no leg flexion
	Check the Brudziński symphyseal sign		
6	Check the Brudziński symphyseal sign in child lying supine <u>commenting all your actions and results:</u> 1) press on pubic symphysis with the border of your hand 2) look at child's legs	Positive symptom: flexion of both hips and knees	Normal -negative symptom: no leg flexion
	Check the Brudzinsky leg sign		
7	Check the Brudzinsky leg sign in child lying supine <u>commenting all your actions and results:</u> 1) passively flex one his leg in the hip and knee 2) look at child's opposite leg	Positive symptom: flexion of the opposite leg	Normal -negative symptom: no flexion of the opposite leg
	Check the Kernig's sign		
8	Check the Kernig's sign in child lying supine <u>commenting all your actions and results:</u> 1) 1) place one hand on one knee of the child; support the shin of the same	Positive symptom: - extension is painful and - it is not possible to completely bend the leg (the angle between the thigh and	Normal- negative symptom: - such movement is easy and painless - tibia extends to a straight line with the hip (180 °)

	limb in the area of the Achilles tendon with the other hand; 2) passively bend the limb in the hip and knee at right angles (90 °); 3) straighten the limb in the knee	the shin when extending the leg is not more than 135 °)	
	Check the Lesage's sign		
9	Check the Lesage's sign <u>commenting all your actions and results</u> : 1) hold the infant under the armpits 2) lift the infant holding his head from the back with your index fingers 3) look at the infant's legs	Positive symptom: - tightening of the legs to the abdomen (flexion in the hips and knees) -continued fixation in such a curved position	Normal- negative symptom: - legs move freely (bend and extend)
10	Complete the examination: announce a conclusion and thank the mother		The child has no signs of meningeal irritation. Thank you.

Notes: * -palpation of the large fontanel and verification of the sign of Lesage is performed in children under the age of 1 year; the Brudzinski and Kernig's signs are examined after 4 months of life, since in healthy children up to 3-4 months of age they are a physiological feature, which is associated with physiological hypertonicity of the muscles that flexes the upper and lower extremities.