

Received: 07 January 2022 / Accepted: 20 April 2022 / Published online: 30 April 2022

DOI 10.34689/SH.2021.24.2.029

UDC 618.2:053.1

PRACTICAL ASPECTS OF NEUROPROTECTIVE TREATMENT IN A NEWBORN WITH MACROSOMIA BORN IN ACUTE HYPOXIA

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Abstract

Relevance: One of the important topical problems in the neonatal period with intranatal fetal hypoxia is hypoxic-ischemic brain damage in newborns. Timely adequate hardware therapeutic hypothermia has a positive neuroprotective effect, and its positive effects exceed its possible complications. In our case, in the early neonatal period, we were able to quickly stabilize the Blood gases (pCO₂, BE, pH, lactate level), and also achieved a reduction in the duration of stay on the ventilator, thereby reducing the duration of hospitalization in the neonatal intensive care unit (NICU). Our patient was successfully extubated on the 4th day of his life, and on the 5th day he was transferred from the neonatal intensive care unit (NICU).

Objective: To present a case of the effectiveness of therapeutic hypothermia in the case of macrosomy of a fetus born in severe asphyxia: clinical manifestations, changes in laboratory parameters and possible outcome.

Materials and methods: Retrospective analysis. This clinical case is described on the basis of the history of the development of a newborn with a large weight, born in severe asphyxia.

Results: In the description of this clinical case, characteristic changes in clinical and laboratory parameters in a newborn boy with a diagnosis of severe asphyxia are given. A large fruit. Hypoxic-ischemic encephalopathy of severe severity. Convulsions of a newborn.

Conclusion: The clinical case was in the Perinatal Center of Semey in 2021. The newborn underwent stabilization measures, followed by transfer to the neonatal intensive care unit (NICU) of the Perinatal Center (PC) in Semey, where intensive therapy was initiated: invasive respiratory support, therapeutic hypothermia for 72 hours, with correction of metabolic disorders, as well as other laboratory changes. In dynamics, against the background of intensive therapy, the condition improved, the child was transferred for further management to the 5th day of life in the department of pathology of Department of Pathology of Newborns and Nursing of Premature Babies (DPNandNPB).

Key words: Fetal macrosomia, asphyxia, hypothermia.

Резюме

ПРАКТИЧЕСКИЕ АСПЕКТЫ ПРИМЕНЕНИЯ НЕЙРОПРОТЕКТИВНОГО ЛЕЧЕНИЯ У НОВОРОЖДЕННОГО С МАКРОСОМИЕЙ, РОЖДЕННОГО В ОСТРОЙ ГИПОКСИИ

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Актуальность: Одним из важных актуальных проблем в неонатальном периоде при интранатальной гипоксии плода является гипоксически-ишемическое поражение головного мозга у новорождённых. Своевременно адекватная аппаратная терапевтическая гипотермия обладает положительным нейропротективным эффектом, и её положительные эффекты превышают её возможные осложнения. В нашем случае в раннем неонатальном периоде смогли быстро стабилизировать данные КЩС (pCO₂, BE, pH, уровень лактата), а так же добились снижения длительности нахождения на ИВЛ, тем самым уменьшили длительность госпитализации в ОриИТН. Наш пациент на 4 сутки жизни благополучно экстубирован, на 5 сутки был переведен из отделения ОриИТН.

Цель: Представить случай эффективности применения лечебной гипотермии в случае макросомии плода, рожденного в тяжелой асфиксии: клинические проявления, изменение лабораторных показателей и возможный исход.

Материалы и методы: ретроспективный анализ. Данный клинический случай описан на основании истории развития новорожденного с крупным весом, рожденного в тяжелой асфиксии.

Результаты: В описании данного клинического случая, приведены характерные изменения клинических и лабораторных показателей у новорожденного мальчика с диагнозом: Асфиксия тяжелой степени. Крупный плод. Гипоксически-ишемическая энцефалопатия тяжелой степени тяжести. Судороги новорожденного.

Вывод: Клинический случай был в Перинатальном центре города Семей в 2021 году. Новорожденному проводились меры стабилизации, с последующим переводом в отделение реанимации и интенсивной терапии новорожденных (ОРИТН) перинатального центра (ПЦ) города Семей, где была начата интенсивная терапия: инвазивная респираторная поддержка, лечебная гипотермия в течении 72 часов, с коррекцией метаболических нарушений, а также других лабораторных изменений. В динамике, на фоне проводимой интенсивной терапии, состояние с улучшением, ребенок для дальнейшего ведения переведен на 5 сутки жизни в отделение патологии новорожденных и выхаживания недоношенных детей (ОПН и ВНД).

Ключевые слова: макросомия плода, асфиксия, гипотермия.

Түйіндеме

ТӨМЕН ДЕНЕ САЛМАҒЫМЕН ЖЕТІЛМЕЙ ТУЫЛҒАН НӘРЕСТЕДЕГІ ТУА БІТКЕН ПНЕВМОНИЯНЫҢ ҚОЛАЙЛЫ НӘТИЖЕЛІ ЖАҒДАЙЫ

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Өзектілігі: Интранатальды ұрықтың гипоксиясы неонаталдық кезеңдегі маңызды өзекті мәселелердің бірі және жаңа туған нәрестелердегі гипоксиялық-ишемиялық бас миының зақымдануының жиі себебі болып табылады. Уақытында аппараттық терапиялық гипотермия оң нейротекторлық әсерге ие және оның оң әсерлері оның ықтимал асқынуларынан қорғайды. Біздің көрсетіп отырған жағдайда ерте неонаталдық кезеңде қышқыл-негіздік күйі (рСО₂, ВЕ, рН, лактат деңгейі) деректерін тез тұрақтандыра алдық, сондай-ақ ӨЖЖ-де болу ұзақтығының төмендеуіне қол жеткіздік, сол арқылы НЖСБ-де (Нәрестелердің Жансақтау Бөлімінде) емдеуге жатқызу ұзақтығын азайттық. Біздің науқас өмірінің 4-ші күнінде экзубацияланады, 5-ші күні НЖС бөлімшесінен ауыстырылды.

Мақсаты: Ауыр асфиксияда туылған ұрықтың макросомиясы жағдайында терапиялық гипотермияны қолданудың тиімділігін ұсыну: клиникалық көріністер, зертханалық көрсеткіштердің өзгеруі және мүмкін нәтижелеріне сүйену.

Материалдар мен әдістер: Ретроспективті талдау. Бұл клиникалық жағдай ауыр асфиксияда туылған үлкен салмағы бар нәрестенің даму тарихы негізінде сипатталған.

Нәтижелері: Осы клиникалық жағдайдың сипаттамасында ауыр дәрежелі асфиксия. Үлкен салмақты нәресте. Ауыр дәрежедегі гипоксиялық-ишемиялық энцефалопатия. Жаңа туылған нәрестенің тырысуы диагнозы бар жаңа туған балада клиникалық және зертханалық көрсеткіштердің тән өзгерістері келтірілген.

Қорытынды: Клиникалық жағдай 2021 жылы Семей қаласының Перинаталдық орталығында болды. Жаңа туған нәрестеге тұрақтандыру шаралары жүргізілді, одан кейін қарқынды терапия басталды: инвазивті респираторлық қолдау, 72 сағат ішінде терапиялық гипотермия, метаболикалық бұзылыстарды түзету, сондай-ақ басқа да зертханалық өзгерістер. Жүргізілген қарқынды терапия аясында бала одан әрі жүргізу үшін жаңа туған нәрестелер патологиясы және шала туған балаларды күту бөлімшесінде (ЖБЖ және ІНҚ) 5 тәулікке ауыстырылды.

Түйінді сөздер: ұрықтың макросомиясы, асфиксия, гипотермия.

Bibliographic citation:

Ailbayeva N.M., Alimbaeva A.R., Tanatarov S.Z., Smailova Zh.K., Lobanov Yu.F. Practical aspects of neuroprotective treatment in a newborn with macrosomia born in acute hypoxia // *Nauka i Zdravookhranenie* [Science & Healthcare]. 2022, (Vol.24) 2, pp. 233-239. doi 10.34689/SH.2022.24.2.029

Аильбаева Н.М., Алимбаева А.Р., Танатаров С.З., Смаилова Ж.К., Лобанов Ю.Ф. Практические аспекты применения нейропротективного лечения у новорожденного с макросомией, рожденного в острой гипоксии // *Наука и Здравоохранение*. 2022. 2(Т.24). С. 233-239. doi 10.34689/SH.2022.24.2.029

Аильбаева Н.М., Алимбаева А.Р., Танатаров С.З., Смаилова Ж.К., Лобанов Ю.Ф. Жедел гипоксияда туылған макросомиясы бар нәрестеде нейропротекторлық емді қолданудың практикалық аспектілері // *Ғылым және Денсаулық сақтау*. 2022. 2 (Т.24). Б. 233-239. doi 10.34689/SH.2022.24.2.029

Relevance

A newborn whose body weight at the time of birth exceeds 4000 g, and the dimensions on the percentile scale exceed the 90th percentile, is diagnosed with fetal macrosomia (M). [3]. In parturient women, the causal factors in the formation of a large fetus are promoted by a sedentary lifestyle, minimal physical activity before childbirth [19]. All over the world, the relevance of macrosomia attracts great attention of doctors of various specialties: neonatologists, neuropathologists, obstetricians, pediatricians. Pathology and morbidity in the postnatal period, as well as lethal outcome in macrosomia are up to 10 times higher than in newborns born with normal weight [5]. Complications of the intranatal period (asphyxia during childbirth), infections and congenital malformations can be the main causes of death in newborns. With proper observance of the patronage service according to international standards, the probability of adverse outcomes is reduced by 16% [8]. *Ibragimov R.R., Zhang P., Liu B., Li G.* in research on the problem of fetal macrosomia highlighted the frequency of increased labor with macrosomia in the range of 8-18.5% over the past decade [4, 25]. Also, the improvement of the social level of women is associated with the birth of large children. A large fetus is a common cause of perinatal pathology. In recent years, delivery by caesarean section has shown a tendency to increase from 5.7% to 26.7% [6]. It has been proven that macrosomia correlates with the risk of complications for both mother and child. Authors *Lahmann P.H., Wills R.A.* conducted an epidemiological study in a cohort of more than 5 million people showed that birth weight of more than 4500 grams and especially more than 5000 grams is associated with a high risk of perinatal and infant morbidity and mortality [22]. This group of children subsequently develop some disorders of the central nervous system (CNS) in conjunction with a lag in physical development. With fetal macrosomia, perinatal mortality in the Russian Federation was 2.7% [10]. Complications in childbirth, maternal and child injuries that have a negative impact on the development of children and lead to an increase in perinatal morbidity and mortality are associated with the type of delivery. Every year, about 5 million newborns die in the world, of which one in five dies from perinatal asphyxia. 10% of newborns need respiratory support, 1% need advanced resuscitation [2,11]. Currently, fetal macrosomia in obstetrics is a significant problem due to the risk of complications, a lack of understanding of the pathophysiology, and the difficulty of prevention. LAA Baburamani, CJ Ek, DW Walker, M. Castillo-Melendez., in their prevalence studies indicate the frequency of hypoxic-ischemic encephalopathy (HIE) in full-term newborns from 2 to 9 cases per 1000 newborns [14, 29], where 10-15% die in the neonatal period [18, 26], and in third world countries the occurrence of HIE reaches 30 cases per 1000 newborns [27, 19]. The cause of death in the first week of life in newborns who underwent severe birth asphyxia is associated with the implementation of multiple organ failure syndrome. In children with severe neurological deficits, aspiration pneumonia or generalization of other infections plays a leading role in the structure of pathologies [30,1]. Childhood disability, such as mental and mental health disorders account for about 50%, while in 80% of children it

is due to perinatal factors [7, 16, 17, 26]. The absence of neurological disorders before the age of 28 days cannot guarantee the absence of long-term neurological consequences. Damage to the white matter of the brain causes a reduced ability to learn and memory disorders in children [1, 15]. 15-20% of children had HIE of moderate severity and had further learning difficulties [28]. The use of therapeutic hypothermia reduces the risk of death in a newborn after severe asphyxia. Therapeutic hypothermia has a neuroprotective effect, which also reduces long-term neurological disorders [13]. Currently, newborns with severe and moderate HIE are also treated with respiratory therapy, which is a predictor of a favorable outcome [12,13,20]. Systematic reviews of the literature describe a significant reduction in mortality and severe neuropsychiatric disability in children who were on therapeutic hypothermia at the age of 18–22 months, as well as at an older age [24]. Relevant is the analysis, evaluation of the effectiveness and safety of those methods that in the first place can positively affect the outcome of treatment and around which the most heated discussions are being held. An important aspect is the improvement of the integrity of technological measures in nursing children from the moment of birth by stabilizing their condition, timely diagnosis of complications, and timely correction in treatment.

Purpose: To present a case of the effectiveness of the use of therapeutic hypothermia in the case of macrosomia of a fetus born with severe asphyxia.

Materials and methods: a retrospective analysis. This clinical case is described on the basis of the history of the development of a newborn with a large weight, born in severe asphyxia, who received therapeutic hypothermia.

Description of the clinical case:

A newborn, a boy, date of birth: 06.11.2021, time 08:40, was born in the Perinatal Center (PC) in Semey, transferred from the operating room to the Neonatal Intensive Care Unit (NICU) 25 minutes after birth with a diagnosis of Severe asphyxia newborn. Large for gestational age.

Anamnesis vitae: Child from 7th pregnancy.

The course of this pregnancy: has been on the dispensary for pregnancy since 14 weeks. I trimester - without features. II trimester - without features. III trimester - inpatient treatment at the Semey Perinatal Center with a diagnosis of Pregnancy 38 weeks 6 days. False contractions. Multiparous. Varicose disease of the lower extremities. Varicose veins of the external genital organs - monitoring the condition of the mother and fetus.

From the prenatal record: Consultation of a geneticist dated 17.05.2021. Ultrasound examination (ultrasound) screening of the first trimester - not passed. Conclusion: Pregnancy 15 weeks. Pregnant risk groups by age factor. A conversation was held about the expediency of conducting invasive prenatal diagnosis to exclude chromosomal pathology - refusal of a pregnant woman. Ophthalmologist from 14.10.2021 - Conjunctival degeneration and deposits (Acute disease)

Mother's diagnosis: 6th singleton birth with a large fetus in occiput presentation at 40 weeks' gestation by caesarean section. Partially progressive detachment of a normally located placenta. Violation of the intrauterine state of the fetus. Multiparous. Varicose veins of the lower extremities and external genitalia. Mild iron deficiency anemia (IDA),

mild degree. Operation: Joel-Cohen laparotomy, caesarean section in the lower uterine segment with a transverse incision.

Birth weight 4000g, height 50cm, head circumference - 37cm, chest circumference -36cm, Apgar score 2-3-4. Temperature 36.6°C.

The condition at birth is severe, due to asphyxia, there is no cry. The skin is clean, pale with a cyanotic tint. Areflexia. Atony. Heart sounds are muffled, heart rate is 101 beats per minute. Saturation 50%. Adopted in warm diapers. Primary resuscitation measures were carried out: Sanitation of the upper respiratory tract, ventilation with an Ambu bag with room air. Heart rate recovered within 120 bpm, monitoring. Given that there is no spontaneous breathing, severe asphyxia, the need for artificial respiration (AR), the child is intubated, and ventilation with an AMBU bag has been started, chest excursion is sufficient. Cyanosis of the skin and mucous membranes is noted, saturation is 82%, mechanical ventilation is started with 100% oxygen. At 10 minutes, blood saturation recovered within 88-89%. Heart rate -136 beats / min. The child in a transport incubator was transferred to the Neonatal Intensive Care Unit (NICU) on a ventilator, saturation 88-89%.

The condition at the time of transfer to the NICU was severe due to asphyxia. Intubated. assisted pulmonary ventilation (APV) is carried out. A child of the correct physique, moderate nutrition, the subcutaneous fat layer is developed evenly. There are no visible malformations. The skin is clean, pale pink, acrocyanosis. Muscle tone is sharply reduced, the position of the "frog". Reflexes of innate automatism are depressed. The head is rounded, the bones of the skull are dense. Large fontanelle 1.0x1.0cm, not tight. In the lungs, breathing is heard evenly in all fields. Heart tones are muffled, rhythmic. Heart rate-136 per min. The abdomen is soft, the liver and spleen are not enlarged. The reproductive organs are developed according to the male type. The stool passed - meconium. There was no urination.

Diagnosis during translation: Main diagnosis: Asphyxia at birth, severe. Large weight for gestational age. We threaten the development of hypoxic-ischemic encephalopathy of the central nervous system. Gestational age 40 weeks. For further observation, examination and treatment, in a transport incubator on a ventilator, the child is transferred to the NICU.

Taking into account the anamnesis: Apgar score ≤ 5 at 10 minutes, the child needs prolonged mechanical ventilation at the 10th minute of life, the presence of specific criteria for severe encephalopathy (convulsive syndrome in the first hours of life), the child is indicated for therapeutic hypothermia. [6].

The clinical diagnosis was made:

Main: Hypoxic-ischemic lesion of the central nervous system, cerebral ischemia III stage, depression syndrome, convulsive syndrome, acute period.

Background: Severe asphyxia at birth.

Companion: Large for gestational age

The child was in the NICU for 5 days. Taking into account the asphyxia at birth, the child received therapeutic hypothermia (72 hours) and survived without complications.

In dynamics, the child is warmed. Consulted by a neurologist, recommendations are being implemented.

BP of 48 mmHg Weight 4085 gr

The child's condition during the observation remains severe, with improvement. The regime is resuscitation, medical and protective. Breathing independent, adequate, receives humidified oxygen through the nasal cannula flow 1 l/min, stable saturation. She is fed through a tube with expressed breast milk, does not spit up. There are no visible seizures. The skin is clean, pale pink, clean. Visible mucous membranes are clean, pale pink. Muscle tone is reduced. The child became more active, opens his eyes. Reflexes of congenital automatism are sluggish, inhibited. Large fontanelle 1.0 x 1.0 cm, not tense, the reaction to light is preserved. The chest is symmetrical. Auscultatory breathing over the lungs is carried out in all fields, there are no wheezing. Heart sounds are muffled, rhythmic. The abdomen is soft. The liver and spleen are not enlarged. The chair comes off. Urination is free, diuresis is preserved. Conclusion: the severity of the condition is due to asphyxia at birth.

Forecast: favorable. Planned therapy continues. Recommended: Transfer to Department of Pathology of Newborns and Nursing of Premature Babies (DPNandNPB).

Laboratory and diagnostic studies

06.11.2021 18:50 Rh factor determination Rh factor - Rh + (positive); Rh factor - Rh + (positive);

06.11.2021 18:51 Glucose in blood serum on the analyzer glucose in blood serum - 7.1 mmol / l;

06.11.2021 19:16 C reactive protein (CRP) on the CRP analyzer - 0.00 mg / l (0);

06.11.2021 19:19 Calculation of the leukoformula of basophils in the blood - 0.0% (0); lymphocytes in the blood - 12.0% (12); metamyelocytes in the blood - 0%; myelocytes in the blood - 0%; monocytes in the blood - 10.0% (10); stab neutrophils in the blood - 16.0% (16); segmented neutrophils in the blood - 61.00% (61); eosinophils in the blood - 1.0% (1); KLA (6 parameters) on the analyzer color index - 1.00000 (1); hematocrit (HCT) in the blood - 52.00000 % (52); relative (%) number of eosinophils (EO%) in the blood - 1.00000% (1); percentage (%) number of lymphocytes (LYM%) in the blood - 12.00000% (12); percentage (%) number of neutrophils (NEUT%) in the blood - 61.00000% (61); absolute number of basophils (BA #) in the blood - 0.00000 / l (0); the absolute number of monocytes (MON #) in the blood - 10.00000 / l (10); the absolute number of neutrophils (NEUT #) in the blood - 16.00000 / l (16); leukocytes in the blood - 30.30000 / l (30.3); platelets (PLT) in the blood - 292.00000 / l (292); erythrocytes (RBC) in the blood - 5.10000 / l (5.1); hemoglobin (HGB) in the blood - 170.00000 g / l (170); ESR (analyzer) - 0.00000 mm / h (0);

06.11.2021 09:05 Blood gases (umbilical cord blood): pH 7.0, pCO₂ 58.0, 2 28.3, VE -17.3, hCO₃ 11.3, lactate 13.0, glucose 5.4 - decompensated metabolic and respiratory acidosis.

06.11.2021 15:00 Blood gases: pH 7.37, pCO₂ 38.0, 2 29.0, VO -2.3, hCO₃ 21.1, lactate 3.5, glucose 5.4 - compensated.

06.11.2021 21:00 Blood gases: pH7,38, pCO₂ 332.2, pO₂ 40.6, VE -5.0, hCO₃ 20.3, lactate 2.2, glucose 4.4 – compensated

Instrumental research:

1. Plain radiography of the chest organs (1 projection) (06.11.2021 09:30) Conclusion: Focal and infiltrative changes were not detected.

2. Echocardiography (06.11.2021 09:30) Conclusion: The cavities of the heart are not dilated. The valves are not changed. Minimal regurgitation on the mitral valve, pulmonary artery valve, small on the tricuspid valve. The contractility of the myocardium of the left ventricle is satisfactory.

3. Neurosonography (06.11.2021 09:30) Conclusion: Signs of ischemic brain damage. 4. Neurosonography (11.11.2021 12:00 pm) Conclusion: No pathology was detected

Audio screening 16.11.2021 passed both ears.

Expert advice:

Consultation: Neurologist (06.11.2021 12:44) Conclusion: Hypoxic-ischemic lesion of the central nervous system, cerebral ischemia III stage, depression syndrome, convulsive syndrome, acute period.

Consultation: Neurologist (11.11.2021 12:45) Conclusion: Diagnosis: Hypoxic-ischemic lesion of the central nervous system, cerebral ischemia I st, convulsive syndrome, o. period. Recommended: phenobarbital 0.003 at night Observation by a neurologist for m/f.

Consultation: Neurologist (16.11.2021 15:44) Conclusion: Diagnosis: Hypoxic-ischemic lesion of the central nervous system, cerebral ischemia I st, convulsive syndrome, o. period, improvement. Recommended: phenobarbital cancel Observation of a neurologist for m/f.

Consultation: Ophthalmologist (06.11.2021 12:44) Conclusion: Moderate angiopathy of retinal vessels in both eyes.

Treatment

1. Protected environment, Resuscitation table mode, medical and protective, ambulant regimen
2. Artificial respiration (AR)
3. Therapeutic hypothermia 72 hours
4. Breast milk
5. Parenteral nutrition
6. Antibacterial therapy
7. Sedative therapy
8. Vasopressor therapy
9. Care

Discharge Status

The child's condition is satisfactory. Sucks actively, does not spit up, gains weight. The skin and visible mucous membranes are clean. The reaction to the inspection is adequate. The musculoskeletal system without visible pathology. The scream is loud. Semi-flexion posture. The head is rounded. Large fontanelle 1.0 x 1.0 cm is not strained. Muscle tone and physical activity are sufficient. Reflexes of innate automatism are called. Puerile breathing over the lungs on auscultation, no wheezing. The heart sounds are clear, the rhythm is correct. The abdomen is not swollen, palpation is soft in all departments, palpation does not cause concern. The umbilical residue is dry. The liver and spleen are not enlarged. Stool yellow, mushy. Urination is free.

Weight-4018,0gr

The child is discharged home with his mother, recommendations for caring for the newborn are given.

Discussion of the results of the study

This case of macrosomia born in severe asphyxia, with manifestations of perinatal CNS pathology, is one of the most important problems of neonatology and resuscitation of newborns. The leading causative factors of macrosomia were, from the anamnesis: a multiparous, age factor of a woman. A factor in the birth of a large fetus in asphyxia was premature detachment of the placenta. According to the World Health Organization (WHO) and the United Nations (UN), intravenous hypoxia is included in the list of pathologies that affect perinatal outcome. [16, 18]. Severe asphyxia at birth (P21.0, P21.1 according to ICD-10) is manifested by difficulty or complete absence of effective breathing in a newborn in the presence of other signs of life at birth. The most serious consequence of severe birth asphyxia is hypoxic-ischemic encephalopathy (HIE) [20, 23]. In this clinical case, timely therapeutic hypothermia in a large fetus led to a favorable course and outcome.

Conclusion: The clinical case was in the Perinatal Center of the city of Semey. The newborn underwent stabilization measures, followed by transfer to the ICU, where intensive therapy was started: invasive respiratory support, therapeutic hypothermia for 72 hours, with correction of metabolic disorders, as well as other laboratory changes. In dynamics, against the background of ongoing intensive therapy, the state improved, the child was transferred for further management on the 5th day of life in acute renal failure and DPN and NPB.

Contribution of the authors: All authors equally participated in the study of the clinical case, analysis and writing of the article.

Conflict of interest: No conflict of interest has been declared.

Financing. When carrying out this work, there was no funding from third-party organizations and medical representative offices.

The work was done on an initiative basis.

Publication details: The results of this case have not been published previously in other journals and are not under consideration by other publishers.

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