УДК: 616.155.194-036:616.24-002:577.118[-053.31
© Tarasova I.V., 2012

PREDICTION OF EARLY ANEMIA PROGRESSING IN NEWBORNS WITH CONGENITAL PNEUMONIA UNDER MICROELEMENTOSES

Tarasova I.V.

Sumy State University, Medical Institute, Sumy

Tarasova I.V. Prediction of Early Anemia Progressing in Newborns with Congenital Pneumonia Under Microelementoses // Український морфологічний альманах. – 2012. – Том 10, № 3. – С. 105-108.

The article deals with the modern opinions concerning prediction of early anemia progressing in newborns with congenital pneumonia under microelementoses. We give the predicting properties of microelement content of cord blood along with history of clinical and laboratory parameters of the newborns, and establishing the algorithm for prediction of early anemia during the neonatal period.

Key words: microelementosis, early anemia, infants, the prognosis.

Тарасова І.В. Прогнозування розвитку ранньої анемії у новонароджених із внутрішньоутробною пневмонією за умов мікроелементозу // Український морфологічний альманах. – 2012. – Том 10, № 3. – С. 105-108.

У статті представлені сучасні погляди на прогнозування ранньої анемії у дітей із внутрішньоутробною пневмонією, за умов мікроелементозу. Встановлені предикторські властивості мікроелементного складу пуповинної крові в комплексі з клініко-анамнестичними та лабораторними показниками у цих новонароджених, що дозволило створити алгоритм прогнозування розвитку ранньої анемії в неонатальному періоді.

Ключові слова: мікроелементоз, рання анемія, новонароджені, прогноз.

Тарасова И.В. Прогнозирование ранней анемии у новорожденных с внутриутробной пневмонией в условиях микроэлементоза // Український морфологічний альманах. – 2012. – Том 10, № 3. – С. 105-108.

В статье представлены современные взгляды на прогнозирование ранней анемии у детей с внутриутробной пневмонией, в условиях микроэлементоза. Установлены предикторские свойства микроэлементного состава пуповинной крови в комплексе с клинико-анамнестическими и лабораторными показателями у этих новорожденных, что позволило создать алгоритм прогнозирования ранней анемии в неонатальном периоде.

Ключовые слова: микроэлементоз, ранняя анемия, новорожденные, прогноз.

Introduction. About 20% of full-term newborns suffer from early anemia, while premature newborns obtain this disease in about 75-100% cases [1, 2]. It is known, that anemia develops after the microelement imbalance [3, 4]. While, data concerning iron and other microelement's deficiency under early anemia pathogenesis is highly debatable. Microelement balance under anemia in newborns with congenital pneumonia is still uninvestigated. Thus, early anemia progressing predictive algorithms formation and usage are highly urgent and necessary in clinical practice. The algorithms have to consider microelement homeostasis, clinic-anamnestic and laboratorial data.

Object. This paper works on clinic-anamnestic parameters, laboratorial data and microelement homeostasis to predict early anemia progressing in full-term and premature newborns with congenital pneumonia.

Materials and methods. There were 35 full-term newborns with congenital pneumonia under the studied, divided into groups: 1) without anemia on 14th day (n=20), 2) with anemia on 14th day (n=15); and 36 premature newborns with pneumonia, they made control groups, such as: 1) with anemia on 14th day (n=15); 2) without anemia on 14th day (n=21).

Wald-Wolflowitz inhomogeneous sequential was used as the statistical approach.

Results and discussion. Calculation of prognosis coefficient and clinic-anamnestic data informativeness in full-term newborns with congenital pneumonia has proved that the following figures had had the high prognosis informativeness: amniotic fluid kind/nature (I=4,150, gestation age (I=3,42), newborns' body weight (I=3,16), newborns condition on the 1st minute by Apgar score (I=1,17), mother's colpitis during the pregnancy period (I=1,18). There are some evidence for early anemia progressing: pure amniotic fluid, gestation age ≤40 weeks, newborns body weight ≤3400g or ≥4001g, newborn condition on the 1st minute by Apgar score ≥8 points, mother's colpitis during the pregnancy, long-lasting latency period, information about amblosises and mortinatuses in the anamnesis, recent pregnancy gestosis, mother' s obesity, intrauterine growth retardation (IUGR), deep-rooted fetoplacental insufficiency absence, threatening miscarriage, mother has more than 4 pregnancies in the anamnesis, first labor and newborn body length ≤50 cm, the newborn of female sex and mother has done aborts.

High informativeness and high predicting features were shown by hemoglobulin (I=4,68) and creatine (I=1,55) contents due to the laboratory tests.

It was proved that all the features have shown high prognostic informativeness while identifying iformativeness for microelements of blood serum. Thus, the anemia development prognostic conditions were Fe (≥13,0umol/l), Mn (≤1,0umol/l), Zn (≤6,2umol/l)contents as well as high contents of Cr

(≥12,01umol/l), Cu (≥5,01umol/l) and Co (≥6,01umol/l).

Contained microelement in erythrocytes had also high prognostic significance. The following statements prove anemia progression: the low content of Cu (≤0,019 ash ug/mg), Zn (≤0,030 ash ug/mg), Fe (≤7,0 ash ug/mg) contents, while the high levels of Cr (≥0,061 ash ug/mg), Co (≥0,045 ash ug/mg) and Mn (0,026 ash ug/mg).

Each microelement in urine has the high prognostic figure. Thus, to demonstrate the anemia progression was used the following figures: high content of Fe (≥0,86umol/l), Cu (≥5,27umol/l), Co (≥0,56umol/l), Mn (≥12,6umol/l) and Zn (≥166umol/l) in urina, with respectively low level of Cr (≤6,11umol/l).

Talking about the microelement prognostic coefficient in general dependably on biological media, which was studied, so the highest figures (I=12,1) were identified in urine comparatively to erythrocytes (I=11,2) and blood serum (I=10,7). That is why, microelement content and its number in urine is the required method of choice due to its noninvasiveness methodology to carry the anemia progression prediction.

Each type of patient examination had high or the very high predictive value, so it based to put these data into the summarize algorithm (table 1).

Table 1. The algorithm of anemia progression in full-term newborns with congenital pneumonia

Figure	Scale	Prognosis coefficient	I
Fe, ig /kg/day	≤3,61 ≥3,62	-11,5 +13,0	12,25
Cu, ig /kg/day	≤23,12 ≥23,13	-11,5 +13,1	12,25
Co, ig /kg/day	≤3,21 ≥3,22	-11,5 +13,0	12,25
Mn, ig /kg/day	≤37,2 ≥37,3	-11,5 +13,0	12,25
Zn, ig /kg/day	≤7,35 ≥7,36	-11,5 +13,0	12,25
Cr, ig/kg/day	≤6,11 ≥6,12	+13,0 -11,5	12,25
Hb, Gm/Dl g/l	≤160 ≥161	+14,9 -4,6	5,34
Amniotic Fluid	pure green or meconium	+6,2 -6,2	4,15
Gestation age, weeks	≤ 40 ≥ 41	+4,6 -7,4	3,42
Body weight, g	≤ 3400 3401-4000 ≥4001	+9,6 -4,6 +1,1	3,16
Blood serum creatine, umol/l	≤100,0 ≥100,1	-3,0 +4,4	1,55
Mother obtained colpitis during pregnancy	Yes No	+2,0 -5,4	1,18
Apgar score on the 1st minute, points	≤7 ≥8	-1,8 +6,0	1,17
Long-lasting latency period	Yes No	+7,3 -1,1	0,92
Total blood protein, g/l	≤54,0 54,1-62,0 ≥62,1	-3,4 +2,3 -2,0	0,91
Erythrocytes $x10^{12}$/l	≤4,5 4,6-4,8 ≥4,9	+4,2 -1,0 -4,6	0,87
Long-lasting fetoplacental insufficiency	Yes No	-4,8 +1,0	-0,78
Hydroamniosis	Yes No	+2,3 -2,0	0,75
Amblosises or mortinatuses	Yes No	+5,2 -1,1	0,73
Pregnancy quantity	≤ 3 ≥4	-1,2 +5,2	0,65
Parity	1 ≥2	+1,7 -3,5	0,65
Abort quantity	0 ≥	-1,6 +2,0	0,62
Mother's obesity	Yes No	-4,3 +1,1	0,59
IUGR (intrauterine growth retardation)	Yes No	+6,0 -1,0	0,49
Recent pregnancy gestosis	Yes No	+6,0 -0,5	0,46

NB. Plus-sign points the possibility of anemia progression, while minus-sign denies its probable progression.

The algorithm approbation on the studied group (n=35) has defined that each examined (100%) had the correct prognosis for ≥95%, ≥99% and ≥99,9% of accuracy level. These results confirm the high reliability of established algorithm.

Calculation of prognosis coefficient and clinic-anamnestic parameter informativeness in full-term newborns with congenital pneumonia has proved that the evidence for the anemia progression are: early development of respiratory distress (≤11 hours), cesarean operation, changed color of amniotic fluid, newborn's CNS depression, placental abruption, mother has bacterial vaginosis during the pregnancy and she is infected by chlamidiosis or herpes virus, the first labor and limited number of mothers' pregnancies (≤2).

Concerning the laboratorial figures, the high informativeness had urea (I=5,90), creatine (I=4,35), alanine transaminase (I=2,99), total blood protein (I=2,88) and total bilirubin (I=2,66) contents.

While identifying informativeness of blood serum microelements, it was pointed out that each microelement had high prognostic informativeness. Besides, the pathogenetic negative factors of anemia progression in newborns with congenital pneumonia are: Fe (≤9,0 umol/l), Co (≤5,0 umol/l), Zn (≤3,0 umol/l), Mn (≤0,024 umol/l), Cr (≤1,0 umol/l) content deficiencies and high Cu level (≥8,15 umol/l).

Table 2. The algorithm of anemia progression in premature newborns with congenital pneumonia

Figure	Scale	Prognosis coefficient	I
Fe, umol/l	≤0,90 ≥0,91	+13,0 -11,0	12,0
Cu, umol/l	≤5,0 ≥5,1	+13,0 -11,0	12,0
Mn, umol/l	≤12,0 ≥12,1	+13,0 -11,0	12,0
Zn, umol/l	≤1,50 ≥1,51	+13,0 -11,0	12,0
Co, umol/l	≤0,40 ≥0,41	-13,0 +11,0	11,40
Cr, umol/l	≤5,51 ≥5,52	+12,1 -10,8	10,8
Urea (7th day), umol/l	≤3,2 ≥3,3	+5,1 -12,0	5,90
Creatine (7th day), umol/l	≤80 ≥81	+4,2 -10,8	4,35
Alanine transaminase (7th day), umol/l	≤0,30 0,31-0,40 ≥0,41	+8,8 +1,8 -6,5	2,99
Total blood protein, g/l	≤45,0 ≥45,1	-10,0 +2,8	2,88
Bilirubin (7th day), umol/l	≤50,0 50,1-90 90,1-110,0 ≥110,1	+5,1 +3,4 0 -9,4	2,66
Respiratory distress establish period, hours	≤11 ≥12	+1,8 -9,5	1,87
Cesarean operation	Yes No	+8,5 -1,8	1,70
Amniotic fluid	Pure Changed	-1,8 +7,4	1,52
Syndrome	CNS oppression increased neuro-reflective excitability multiorgan failure	+1,8 0 -7,8	1,26
Placental abruption	Yes No	+6,8 -1,5	1,21
Erythrocytes x10^{12}/l	≤4,7 4,8-4,9 ≥5,0	+1,8 +1,1 -7,0	0,93
Bacterial vaginosis	Yes No	+6,1 -1,1	0,86
Parity	1 2 ≥	+3,2 0 -4,0	0,64
Pregnancy number/quantity	≤2 3-4 ≥5	+1,8 0 -3,2	0,57
Toxemia of pregnancy	Yes No	-5,8 +1,1	0,50

NB. Plus-sign points the possibility of anemia progression, while minus-sign denies its probable progression.

Studying prognostic importance of microelements' contents in erythrocytes, thus incredibly high (I≥6,0) predicting qualities were very common for each microelement. Moreover, there are figures to

prove anemia progression: Fe (≤6,0 ug/mg ash), Cr (≤0,058 ug/mg ash), Co (≤0,030 ug/mg ash), Mn (≤0,024 ug/mg ash) content deficiencies and high Zn (≥0,24 ug/mg ash) and Cu (≥0,33 ug/mg ash) levels.

High prognostic qualities of microelement content in urine were also identified. For this purpose as criteria for anemia predicting are: Fe (≤0,90 umol/l), Zn (≥1,50 umol/l), Cr (≤5,51 umol/l) concentrations and high levels of Cu (≥5,1 umol/l), Mn (≥12,1 umol/l) and Co (≥0,41 umol/l) in urine.

The comparison study of microelement content informativeness in different patient's media has proved that it is very high and similar for any type of calculation microelement content. These results give a possibility to use the microelement content noninvasive method to predict anemia progressing for such newborns, in urine.

Each type of patient examination had a certain prognostic informativeness value, thus leads to putting these data into the summarize algorithm (table 2).

The algorithm approbation on the experimental group (n=35) has defined that each examined (100%) had the correct prognosis for ≥95% and ≥99,9% of accuracy level, while the level of accuracy ≥99.9% had 97,3% of examined. There was any incorrect prognosis. These results confirm the high reliability of marked/established algorithm.

Investigating the ordered pathogenetic parameter role in full-tern and premature newborns along with congenital pneumonia (tab.1) has confirmed that each experimental group had microelement deficiency as the main pathogenesis feature. Moreover, the order factors for any other characteristics were incredibly different either for feature quantity or feature quality.

Table 3. Ordered parameters of anemia pathogenesis in newborns with congenital pneumonia

N	Full-tern newborns	Premature newborns
1	Microelement deficiency	Microelement deficiency
2	Anemia pregnant women	Protein metabolism deficiency
3	Gynecopathy deficiency	Enzymatic liver function deficiency
4	Newborn scale by Apgar score <5	Pigmental liver function
5	Birth defects	Early establishment of respiratory distress
6	Long-lasting fetoplacental insufficiency	Caesarean operation
7		CNS distress
8		Pregnancy failure
9		Mother's gynecopathy

Перспективи подальших розробок. Розроблені алгоритми прогнозування дозволять проводити профілактику ранньої анемії у новонароджених з внутрішньоутробною пневмонією та покращити методи корекції цього ускладнення.

Conclusion:

1. The usage of the predicting features of umbilical blood microelement content along with clinic-anamnectic and laboratorial tests for full-term and premature newborns with congenital pneumonia, gives the background for establishing the early anemia progressing algorithm during neonatal period. Microelementoses is the important feature of anemia pathogenesis, irrespectively to its gestation period.
2. It is proper to use the noninvasive method for anemia progressing prediction of microelement content in urine, due to its very high prognosis informetiveness (I=11,9).
3. The ordered parameters of anemia pathogenesis in newborns with congenital pneumonia are strictly different as to its quantity or quality (full-term newborns have 7, while premature newborns have 9). Moreover, the main feature is microelement imbalance and its deficiency aside from its gestation age.
4. The high accuracy of established prognosis algorithms gives a possibility to involve them in clinical practice.

REFERENCES:

1. Balducci L. Anemia, fatigue and aging / L. Balducci // Transfus. Clin. Biol. – 2010. – №17 (5-6). – P. 375-381.
2. Beard J. Resent Evidence from Human and Animal Stadies Regarding Iron Status and Infant Development / J. Bear // J. Nutrition. – 2007. – Vol. 137.- P.524S-530S.
3. Wiliams A.F. Pediatrics Nutrition. In: Clinical Nutrition / M.I. Gibney, M.Elia, O.Ljungqvist [et al.] : Blackwell Science, Oxford. – 2006. – P.379-427.
4. Greenbaum L.A. Micronutrient Mineral Deficiencies. In: Nelson Textbook of Pediatrics, Vol.1 / R.M.Kliegman, R.E.Behrman, H.B.Jenson [et al.]: 16th ed. Philadelphia, Sanders. –2007. – P. 265-266.

Надійшла 16.06.2012 р.
Рецензент: проф. В.І.Лузін