

**THE ESSENTIAL MICROELEMENT SUPPLYING AND ITS BALANCE
UNDER THE RESPIRATORY DISTRESS SYNDROME OF PREMATURE
NEWBORNS**

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The article is devoted to study the peculiarities of essential microelements' levels (such as iron, zinc, copper, cobalt, manganese and chrome), which have the premature newborns with respiratory distress syndrome in progress of the first two weeks of life. The morphofunctional immaturity of premature newborns with RDS is the most determining point of the microelements' deficiencies. Whereas, the prevailing influence on Fe, Zn, Cu, Co, Cr and Mn contents and balances in these media have the gestation age factor.

Key words: *microelements, newborns, respiratory distress syndrome*

INTRODUCTION

Respiratory distress syndrome (RDS) fills a highly important place in the neonatal mortality structure. It develops as the consequence after the surfactant deficiency state, but mostly the premature newborns obtain it. The prematurity frequency is 6,5–10 %, it does not have tendency towards decreasing. Importance of this issue investigation is raised because of the high mortality level, infant sickliness and disability [1, 2]. The figures of infant sickliness and the severity of pathology are gone far beyond those figures, which were shown by the full-term newborns [3].

The microelementosis issue is been highly investigated recently. It is caused of microelement's importance in organisms biochemical reactions and its significant role in the enormous number of diseases pathogenesis [4, 5].

Microelement imbalance and deficiency provoke the disorders in vital processes as well as the postnatal life adaptation condition issues. The above mentioned statements give the background for investigation actuality of the premature newborn's microelement supply particularly those, who have RDS.

OBJECT

The object of the research is to study the peculiarities of essential microelements' levels (such as iron, zinc, copper, cobalt, manganese and chrome), which have the premature newborns with respiratory distress syndrome during the first two weeks of life.

MATERIALS AND INVESTIGATION METHODS

Under the investigation there were 47 premature newborns with RDS. The gestation age of the studied groups was 28–36 weeks. The control group contained 12 healthy newborns.

For diagnosis verification there were used the following methods: general analysis (examination, percussion, auscultation); laboratory-based (clinical examination, biochemical) and functional examination methods (roentgenologic, ultrasound, electrocardiographic).

The microelements' levels (in serum, erythrocyte and urine) were identified with the atomic-absorption spectrophotometry method. As the equipment there was used the spectrophotometer C-115M1, produced by JSC "Selmi", Ukraine. It is tolled with the computer-box, the aim of which is the automatic calculation of the microelements' levels. Apart from the

microelement concentration in urine (umol/l), the daily microelements' excretions per kilogram of weight were calculated as well (mcg/kg/day). The microelement content was studied on umbilical blood and also on the 7th and 14th days.

The statistical analysis of the figured results was carried on Excel-program. The analysis of variance approaches were used as these methods are acceptable to biomedicine. Every figure had the averaging (M), the mean averaging error (m). The certainty index (p) was pointed out due to the Student's criterion (t). The analysis of variance was used to study the severity of hypoxia, life period and gestation terms in microelements' contents of certain biological media.

RESULTS AND THEIR DISCUSSIONS

The iron level reducing was identified in newborn umbilical blood, who had RDS (up to 21,1 % in serum and up to 6,4 % in erythrocyte respectively). On 14th day iron level indexes have positively increased at this media, despite on this fact, it was still 1,2 times lower than the conditional healthy newborns obtained. Comparing to conditional healthy newborns the urinary concentration and iron excretion have been 3 times higher in their first day of life. During the first two weeks of life the concentration has been increasing up to 25,4 %, while this microelement loss by urine has increased up to 39,8 % as well.

The iron level of serum and erythrocyte as well as its urinary concentration and excretion volumes were totally depended only on gestation term. This confirms the significant influence of the certain factor on microelement metabolism, which was obtained by RDS-newborns. Iron efficiency on the above mentioned figures under these conditions are the following 63,86 % (p 0,05), 60,05 % (p 0,05), 42,85 % (p 0,05) and 58,49 % (p 0,05).

The enormous zinc content reducing (up to 50,6 %) was noticed in serum and vice versa effect, like the increasing of its level at erythrocyte (to 15,4 %) in umbilical blood of premature newborns under RDS was identified as well. During the early neonatal period its volume figures were increasing in blood serum while it did not change in erythrocytes. On the 14th day of live the zinc level was still 1,4 times lower in the serum and, conversely, was 1,2 times higher for children erythrocyte, who have born RDS comparing to those, who were conditional healthy newborn.

On the 1st day of live zinc concentration increasing was pointed out in urine up to 1,6 times as well as the tendency towards excretion intensifying. While on the 14th day zinc concentration in urine was 53 % and the excretion 24,3 % higher comparing to conditional healthy newborns data.

Due to analysis of variance it was identified that the zinc level of children with RDS had shown the significant gestation term factor influence on serum and erythrocyte. Moreover, the efficiency is from 69,39 % (p 0,05) to 86,00 % (p 0,05).

Under RDS the appreciable copper content increasing was discovered in umbilical blood (to 35,6 %) and the vice versa data we have got concerning its reducing in erythrocyte (up to 40,8 %). During the progressive early neonatal period its level was reducing in serum blood enormously, and at the same time was significantly increasing in erythrocyte. On the 14th day of life the copper level was higher in serum for 7 % and vice versa; it was lower in children erythrocyte, who have born RDS. Its was 43,1 % lower comparing to conditional healthy newborns.

The newborns under RDS had approximately two times increasing of copper concentration and its excretion. The newborns had the copper concentration in urine for 57,8 % as well as the excretion level was for

52,0 % higher than those conditional healthy newborns obtained, it was during the first two weeks of live.

The monitored factors influence analysis on copper level in the biological media of children with RDS has pointed out that the factor efficiency goes far beyond the gestation terms. That's why its efficiency on element's content in serum is 76,46 % (p 0,05), in erythrocyte – 72,80 % (p 0,05), in urine – 78,80 % (p 0,05) and for the daily excretion is 73,30 % (p 0,05). Besides, the slight, but certain, figure interaction influence factor was identified for metal content in erythrocyte and its daily excretion with 17,47 % (p 0,05) and 18,62 % (p 0,05) respectively.

On the back of RDS the significant cobalt content was identified in serum (up to 35,8 %) and in umbilical blood erythrocyte (up to 66,2 %), it is comparing to conditional healthy newborns. During the early neonatal period the content figures of its element were rapidly reducing in blood serum and did not change in erythrocyte. On the 14th day of live the cobalt level was up to 52,9 % in erythrocyte as well as in children serum up to 14,1 % higher respectively than its level of conditional healthy newborns.

On the 1st day of life the significant reducing of cobalt concentration and excretion was identified. So, on the 14th day of live the cobalt concentration in premature newborn urine with RDS was up to 17,6 % as well as the excretion was up to 44,6 % lower than its level in conditional healthy newborns.

The children with RDS have the obvious prevailing gestation term influence on cobalt level in serum and its daily excretion with efficiency 63,67 % (p 0,05) and 94,94 % (p 0,05) respectively. The important determinant of its level in serum is newborn life length. The efficiency of its factor is 23,43 % (p 0,05). The unmonitored factor efficiency on the element's level in erythrocyte and urina is significant, thus it is 80,15 % (p 0,05) and 86,61 % (p 0,05).

In case of RDS the umbilical blood of premature newborns contained enormous chrome content (up to 70,3 % in the serum and 71,1 % in erythrocyte). On the 14th day of life its level have reduced, thus chrome content in serum was 6 times as well as its content in erythrocyte was 2 times lower respectively comparing to conditional healthy newborns.

On the 1st day of life the significant decreasing of chrome urine concentration and its excretion was identified comparing to conditional healthy newborns. Microelement's concentration and excretion with urine was constant. On the second week of live chrome concentration cut up to 33,2 %, and its loss with urine did not differ much from the conditional healthy newborn figure.

The monitored factors had no influence on the chrome level in serum and erythrocyte of newborns with RDS. However, the unmonitored factor efficiency is 77,52 % (p 0,05) and 90,46 % (p 0,05). This element level in urine and its daily excretion is distinguished mostly by the gestation term. The efficiencies are 68,92 % (p 0,05) and 77,54 % (p 0,05) respectively. The slight, but determining role has the life length factor, its efficiencies are 13,22 % (p 0,05) and 12,97 % (p 0,05).

The significant reducing of manganese content in umbilical blood for children with RDS was pointed in serum (up to 52,5 %) and in erythrocyte (up to 40,8 %). During the neonatal period its level was slightly increasing, but on the 14th day of live the manganese content was still lower than its level of conditional healthy newborns, for instance the lowness was for 52,3 % in serum and 65,0 % in erythrocyte.

The newborns with RDS on the first day of live had the significant increasing of manganese urine concentration and manganese excretion. During the first two week of life these figures were constantly increasing. On the 14th day of life the manganese concentration in urine was for 27,3 %

higher, while the excretion was for 42,0 % higher than its level of conditional healthy newborns.

Due to the analysis of variance the children with RDS were not influenced on manganese level in serum by monitored factors. On the other hand, the efficiency of unmonitored factors is 85,125 (p 0,05). On the same time the element content in erythrocyte is directly depended on gestation term, as well as on newborn life length. So, the efficiency of factors are 63,25 % (p 0,05) and 15,84 % (p 0,05) respectively. The manganese level in urine and its daily excretion is depended on gestation term. Its efficiency is 67,97 % (p 0,05) and 73,13 % (p 0,05) respectively.

Summing up the significant decreasing of manganese content in serum and in erythrocyte of children with RDS umbilical blood is proofed, especially during the neonatal period. The element concentration and its excretion in urine are high.

Confirming the analysis on essential microelement supplying and its balance of premature newborns with RDS, this all point that under this pathology the most significant changes of microelement content and its serious deviations can occur. Thus, under RDS the iron, zinc and manganese deficit in serum and erythrocyte are highly spreaded and can constantly last. Beside, these media are overfilled with copper and cobalt. Taking about chrome, the blood serum is stuffed with it, while erythrocyte has its 6 times deficit. To a certain extent, the iron, zinc and manganese deficit, and microelement imbalance are determined by its significant concentration in urine and its renal excretion, but only in case of this pathology. On the other hand, the high level of cobalt in erythrocyte and serum can be directly depended on its urine concentration reducing and depressed renal excretion.

The gestational age has a prevailing influence on iron, zinc, copper, cobalt, chrome and manganese contents and balances. This gives a background to claim that the morphofunctional immaturity of premature newborns with RDS is the most determining point of the microelement's deficit.

CONCLUSION

1. Under RDS can occur the significant changes of microelement contents and their rough imbalances, such as are Fe, Zn and Mn deficit in serum and erythrocyte. While these media can be overfilled with Cu and Co. Moreover, blood serum is stuffed with Cr, while its six-time deficit is identified in erythrocyte.

2. On a certain degree, Fe, Zn and Mn deficits and imbalances are determined by the significant increasing of renal excretion under this pathology. On the same time the high content of Co in erythrocyte and serum, as well as the high level of Cr in serum can occur because of the renal excretion depression.

3. The morphofunctional immaturity of premature newborns with RDS is the most determining point of the microelements' deficiencies. Whereas, the prevailing influence on Fe, Zn, Cu, Co, Cr and Mn contents and balances in these media have the gestation age factor.

ВМІСТ ТА БАЛАНС ЕСЕНЦІЙНИХ МІКРОЕЛЕМЕНТІВ У НЕДОНОШЕНИХ НОВОНАРОДЖЕНИХ ІЗ РЕСПІРАТОРНИМ ДИСТРЕС-СИНДРОМОМ

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Стаття присвячена вивченню особливостей рівня вмісту есенційних мікроелементів (залізо, цинк, мідь, кобальт, марганець та хром) у недоношених новонароджених із респіраторним дистрес-синдромом у динаміці перших двох тижнів життя. Морфофункціональна незрілість організму недоношених новонароджених із РДС є основним

чинником мікроелементарних порушень. Вміст та баланс Fe, Zn, Cu, Co, Cr та Mn у біосередовищах цих новонароджених суттєво залежить від гестаційного віку.

Ключові слова: мікроелементи, новонароджені, респіраторний дистрес-синдром.

СОДЕРЖАНИЕ И БАЛАНС ЭСSENЦИАЛЬНЫХ МИКРОЭЛЕМЕНТОВ У НЕДОНОШЕННЫХ НОВОРОЖДЕННЫХ С РЕСПИРАТОРНЫМ ДИСТРЕСС-СИНДРОМОМ

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Статья посвящена изучению особенностей уровня содержания эссенциальных микроэлементов (железо, цинк, медь, кобальт, марганец и хром) у недоношенных новорожденных с респираторным дистресс-синдромом в динамике первых двух недель жизни. Морфофункциональная незрелость организма недоношенных новорожденных с РДС является основной причиной нарушения баланса микроэлементов. В то же время значительное влияние на уровень и баланс Fe, Zn, Cu, Co, Cr и Mn в биосредах новорожденных имеет фактор гестационного возраста.

Ключевые слова: микроэлементы, новорожденные, респираторный дистресс – синдром.

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