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EARLY DYAGNOSIS OF NECROTIZING ENTEROCOLITIS IN THE NEWBORNS

ABSTRACT

Necrotizing enterocolitis (NEC) today hasn't objective reliable laboratory markers for early diagnosis. The article presents the results of studying structural and functional properties of erythrocyte membranes (structural-functional state - SFS) using original method for automatic registration of acidic and osmotic erythrogram (ARAOE) in 50 healthy newborns and 90 suffering from NEC. The study highlighted two laboratory markers, significantly changing their values depending on the stage of the disease.

Keywords: necrotizing enterocolitis, NEC, newborns, hemolysis, erythrocytes.

Objective: to identify the dependence of erythrocyte membranes structural-functional properties from clinical stages of NEC in newborns and to assess their diagnostic value.

Tasks

1. To evaluate structural-functional state of erythrocyte membranes in healthy newborns and NEK newborns with the help of automatic registration of acidic and osmotic erythrogram method.

2. To identify significantly changing of SFS in neonates with NEC depending on the stages of the disease.

MATERIAL AND METHODS

The study included 140 infants. The control group consisted of 50 healthy children (group A) and a group of 90 infants with NEC at different stages (group B).

Group A included 50 healthy newborns with a gestational age of 38-40 weeks, weighing 3500-3850g.

In group B 70% of the newborns were premature. Among concomitant pathology dominated brain ischemia of different severity (100% of cases). Intrauterine infection and septic state was accompanied by the incidence in 93.3% of cases. 74.4% of infants in group B had a weight less 2500 g., including at least 1000g. – 10%.

The study of the SFS method (ARAOE) was carried out according to the method developed at the Department of biophysics and biology faculty FGBOU VPO «Voronezh state University». Equipment: 56M FEK with integrated differential amplifier, two-coordinate recorder 4 LKD – 003, digital voltmeter

Table 1

Distribution on disease stages in the group "B" (n 90)

	Стадии НЭК, по Walsh и Kliegman					
NEC stages (Walsh & Kliegman)	IA	IB	IIA	IIB	IIIA	IIIB
Total (n 90)	22	20	18	10	12	8

Table 2

Distribution on gestational age in the group "B" (n=90)

Gestational age, (weeks)	Value, %
26-30	24
31-36	46
37-42	30

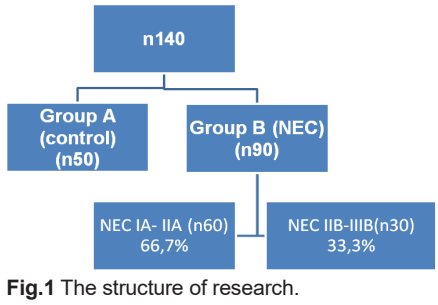

Fig.1 The structure of research.

Table 3

Distribution of newborns on weight in the group "B"

Weight	Value, %
< 1 кг (n9)	10,0
1-2,4 кг (n58)	64,40
2,5-3,2 кг (n23)	25,60

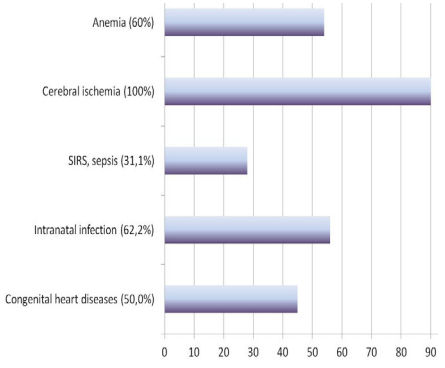

Fig.2 Complementary pathology in the B gr. (n=90)

type B7-20, thermostat UTU-6 and personal computer.

The principle of the method ARAOE is a photometric check of the process of erythrocytes hemolysis. Kinetic curves (erythrogramma) are graphic display of the sequential joining of red blood cells of various degrees of resistance to the stage of hemolysis.

The phases of research execution:

1. Blood sampling and preparation of erythrocyte suspension.
2. The study of hemolysis of red blood cells.
3. Check results.

Statistical data processing was carried out on a personal computer using the statistical software package STATISTICA of StatSoft company, Inc., (USA) BIOSTAT version of 3.03 of the company Mc Graw-Hill, Inc. (USA).

Table 4

Results of the surgical treatment in the group "B"

Results of the surgical treatment	Absolute quantity	Relative value, %
Surgery	30	100
Survived	26	86,6
Lethality	4	13,4

THE RESULTS OF RESEARCH AND DISCUSSION

The obtained data demonstrates the growth of the constant maximum speed of hemolysis (Cmax) and the decrease in the acid resistance of the membranes (tlat) in the cases of clinical deterioration.

CONCLUSIONS

1. All investigated parameters of SFS method (ARAOE) is statistically significantly associated with the stages of NEC in newborns.

Table 5

The studied indicators with АРКОЭ method

Unit	Value
G 120, %	Hypoosmotic hemolysis (the largest part of destroyed erythrocytes, placed in S.NaCl 0,55% during 2 min.).
G 30, %	Hypoosmotic hemolysis (the largest part of destroyed erythrocytes, placed in S.NaCl 0,55% during 30 min.).
G max, %	The largest part of the destroyed erythrocytes with hemolysis.
K max	Constant of the maximum speed of hemolysis.
t lat, sec.	The acid resistance of the erythrocytes.

2. The highest correlation coefficients are characteristic of the constant maximum speed of hemolysis (Cmax) (direct) and acid resistance (tlat) (reverse).

3. Newborns with the most severe NEC have the highest value of the indicator Cmax the smallest tlat.

4. There is a high statistically significant correlation between Cmax and tlat with the stages of NEC in newborns, that in combination with the low cost and ease of process definition allows to consider them as a promising additional markers for early diagnosis of this disease.

Table 6

The comparative characteristic of the average values of the measured indicators in researching groups

Researching group	G120, %	G30, %	Gmax, %	Kmax, o.e.	t лат, сек
Control gr. (n=50)	0,76±0,04	36,54±0,57	46±0,71	0,27±0,01	155,1±5,05
NEC IA-IIA	1,45±0,16	52,12±1,27	65,3±1,38	0,5±0	84,9±2,91
NEC IIB-IIIB	-2,25±0,32	45,0±0,45	65,57±1,3	0,97±0,27	66,67±1,52
Coefficients of reliability of differences between groups with the Student's criterion					
Control gr. - NEC IA-IIA	0,000011	0,000002	0,000001	0,000011	0,000001
Control gr.- NEC IIB-IIIB	0,000001	0,000001	0,000004	0,000001	0,000001
NEC IA-IIA - NEC IIB-IIIB	0,000000	0,000001	0,938322	0,000001	0,000001

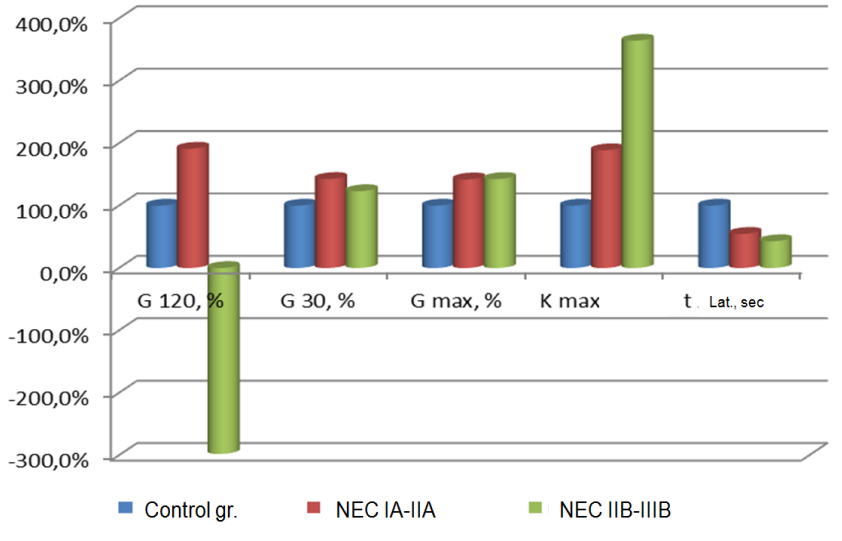

Fig.3 The units values of the АРКОЭ- method

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Table 7

The correlation coefficients (NEC clinical gravity vs structural properties of the erythrocytes)

Unit	The correlation coefficient value	p
G 120, %	-0,60141	0,005
G 30, %	0,441241	0,032
G max, %	0,723849	0,001
Kmax, o.e.	0,840725	0,001
tлат., с.	-0,81557	0,001

Table 8

The regression model of influence of the NEC clinical gravity on erythrocytes properties

Unit	Coefficient	Standard error	T-statistics	Significance value
Constant	0,574221	0,237469	2,41809	0,0172
G120	0,00514457	0,0189083	0,27208	0,7860
G30	0,0137278	0,00273114	5,02642	0,0000
Gmax	0,0133121	0,00274893	4,84263	0,0000
Kmax	0,123543	0,0093605	13,1983	0,0000
T lat	-0,00407331	0,000768043	-5,30349	0,0000

Note. Determination coefficient R2=92,69%. Standard error = 0,216124. Average absolute percentage error of forecasting = 0,165798.

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