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INDICES OF ACID-BASE STATE (ABS) IN BLOOD AND AMNIOTIC FLUID AS A MODULE OF EXPRESSION 0F INTRANATAL FETUS AUTOHYBERNATION

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ABS in blood of parturient, fetus, neonate and in amniotic fluid in labour has been studied; a nomogram for a buffer line of ABS in amniotic fluid is proposed; optimum parameters of medium for the development of a hybernation state of fetus have been revealed taking into consideration the degree of cervical dilation in the first labour period as well as the second in which natural fetal hybernation (autohybernation) is observed. Acidification of fetal blood and amniotic fluid was found to be an indicatin of optimum medium and a module of fetal autohybemation manifestation. Distinction between slight, normal and deep fetal autohybemation has been attempted for selecting correct tactics of labour control providing decrease of neonatal trauma and hypoxia incidence.

INTRODUCTION

Intranatal fetal hybernation first described in 1983 (Babkina, 1983) is characterized by inhibition of the central nervous system functions during the second period of labour when fetus resembles in appearance a neonate in the state of profound narcosis, with respiratory standstill. Intranatal hybemation is regarded by the above author as main adaptative reaction for maintaining viability of fetus.

At present the importance of uterine contractile activity in labour is beyond doubt.

As demonstrated by K. Chachava and G. Shonia (1969), activation of contractile ability of myometrium during uncomplicated passage of fetus through natural labour canals is followed by moderate metabolic acidosis in parturients BE=/3/-/-6/mmol/l (where BE is deficit of bases and surplus of acids); shift in the base direction increases labour and acidosis, these followed by the decline of myometrium contractile ability.

Since the presence of medium pH, optimum for the activity of the enzymes regulating an acetylcholine exchange (Raiskina, 1962) appears obvious, we assume that the control of fetaI blood ABS and the existence of gradient between parturient and fetus is a reaction of the development of optimum medium for the functions of parasympathetic mediator and hence, for myometrium activation in parturient and autohybernation in fetus.

It is known that pH 7.20-7.30 is an optimum condition for the activation of acetylcholine synthetase, while base medium is the optimum on condition for cholinesterase-7,45-7,55 (Raiskina, 1962).

Next attempt was made to study the state of blood ABS of parturient, fetus, neonate and amniotic fluid in order to determine the optimum medium for autohybemation and its role in labour.

MATERIAL AND METHODS

The blood of 550 parturients in various pathologic conditions and 40 practically healthy parturients in uncomplicated labour was examined. Simultaneously blood ABS of parturient, fetus and neonate (from umblical vein prior to the first breath) was studied in 350 parturients of the pathologic group (EPH-Gestosis-300, heart diseases of rheumatic etiology - 50 women) and in 40 subjects of control group with uncomplicated labour and no fetus trauma or hypoxia. In 30 examined parturients with pathology and in 10 somatically healthy persons with an uncomplicated labour the analysis of blood of parturient, fetus, neonate and amniotic fluid was performed. For investigations "AVL"-939-338 was used.

In the group of neonates Apgar scores, gen. eral state, the first cry, and the presence of reflexes immediately after birth were taken into consideration.

RESULTS

The study of blood ABS of the control parturients has revealed a moderate uncomplicated metabolic acidosis. In 35% of the examined pH ranged within normall limits for healthy women, while pO_2 (where pO_2 is the oxygen pressure) did not exceed the low normal limit in any single case (11.99kPa).

Weakness of myometrium is aggravated by both the accumulation of underoxidated metabolites, and the increase of hypoxemia, characteristic for the parturients with various pathologies (EPH-Gestosis, rheumatic heart disease) pH=7.27±0,02, BE=-10.1±0.5 mmol/l, pO_2=6.9±0.4kPa.

Adaptive reactions in metabolism followed by shifts in blood ABS are characteristic of a normal parturient organism. These shifts should be considered more normal than hypoxemia and metabolic shifts of blood ABS. In the group with pathologies the shifts of ABS beyond the limits of normal blood ABS in base (27%), or in acid directions was detected in practical1y healthy parturients. Moderate metabolic acidosis (BE=/-3/-/-6/) should be regarded as an index for optimum medium (pH=7.22-7.30) as wel1 as for the levels of activity of acetylcholinesynthetase and acetylcholinesterase suppression at the stage of maximum activity of the myometrium ready for labour.

The ABS index (pH over 7.35, BE over 2.0 mmol\1) reflects the extreme activity of myometrium contractibility, while profound acidosis (pH below 7.20, BE below /-8/-/-10/ mmol/l) points to the increase in acetylclcholinsynthetase activity and cholinesterase blockade. Hence, excessive accumulation of acetylcholine or the development of optimum medium for the functioning of mediators of parasympathetic activity results in the weakness of myometrium.

As parturient supplies fetal blood with oxygen determining ABS level, the need in oxygen rises, this respectively increasing fetal acidosis. In the control group (n= 10) blood samples taken before the first breath from neonatal umbi1ical vein pH=7.21±0.2, BE=/-5/, while in the cases of fetal hypoxia and weakness of myometrium pH=7.9±0.02 and BE=/-16/. However, parallels cannot always be drawn between the blood ABS of a parturient and neonate. Deep acidosis in parturient is not necessarily followed by even deeper acidosis or alkalosis of neonate. The observed individual change of fetus in blood ABS enables the location and isolation of its regulatory reaction.

Hence, it can be assumed that the isolated local alteration in fetal blood ABS is characteristic of the development of autohybernation.. pH=7.21±0.5, BE=-5.0±0.3 are optimum autohybemation criteria above which no optimum hybernation is observed, and below which deep autohybernation occurs.

DISCUSSION

As reported earlier (Abramchenko et al., 1988), during labour when cervix is di1ated a gradual decrease inamniotic fuid pH occurs, this being indicative of the buffer capacity exhaustion. Reported parameters of amniotic f1uid pH reveal the absence of intrauterine fetal hypoxia. A clear correlation between the acidity of amniotic f1uid and fetal blood found by the authors enables to speculate on functiol1al capabilities of fetus during labour, dependent on the change in the acidity of amniotic f1uid.

In the subsequent series of tests (38 parturients with heart rheumatic. disease and 10 healthy parturients) the blood ABS of women, neonates (the umbilical vein blood prior to the first breath) . and the pH of amniotic f1uid (Table 1) in the 2nd labour period were investigated.

In Table I a certain gradient between the blood ABS of parturient and neonate ($p < 0.5$) is presented. Individual observations of blood ABS have shown the absence of correlation between them. The gradient and relative correlation are observed in healthy parturients with reliable stability. In case of pathology the gradients were minimal in 3l% of patients and very high in 28%, pH difference amounting to 0.1 with the normal range of 0.04-0.05.

It can be assumed that pathologic labour is characterized by the change in ABS gradient of mother and fetus which points to the failure of a protective reaction of placental membrane between them, and displays the autohybernation reaction of fetus in different aspect.

At the same time, more stable gradient of blood pH in the control group promotes the optimization of blood homeostasis for autohybemation of fetus. Comparison of maternal blood PCO_2 (capillary and venous) with neonatal PCO_2 has shown that pCO_2 in the umbilical vein before the first breath is very close to that of the maternal venous

Table 1. Blood ABS of parturient, neonate (before the first breath) and amniotic f1uid pH in normal and pathologic labour

	Normal			Pathology		
	Parturient	Neonate	Amniotic f1uid	Parturient	Neonate	Amniotic Fluid
P02	78.0 ±O.9	35.5 ±O.7	-	70.3 ±l.0	30.3 ±0.7	
802	92.3 ±0.8	53.5 ±O.6	-	91.0 ±O.71	48.5 ±O.6	
PC02	33.5: ±O.7	35.0 ±O.7	-	33.5 ±O.7	34.5 ±0.7	
AB	18.81 ±0.5	17.8 ±0.5	-	18.0 ±O.5	17.1 ±0.5	
pH	7.35: ±0.02	7.21 ±.O.02	7.04 ±0.3	7.36 ±0.02	7.19 ±0.02	7.0 ±.003
Be	-1.5: ±0.2	-5.01 ±0.2	-	6.0 ±0.2	-7.8: ±O.2	

blood, and exceeds by 0.4-0.7 kPa the similar index of the maternal capillary blood. Besides, their activity of carboanhydrase in blood promoting a reaction $HHCO_3$ HCO_3 + H, does not differ.

Basing оп the results, we offer a formula (proceeding from the nomogram) for the interpretation of amniotic fluid ABS:

1.56· pCO_2/pH-7.0/=AB 1) where pCO_2 is the sum of maternal pCO_2+0.3kPa, pH - the index of amniotic fluid pH, AB - the calculated value of true bicarbonate.

Since . the deficiency of bicarbonate ions HCO_3 multiplied by 1.56 is the index of BE level, that level can be attained by subtracting AB=23.0 mmol\l of the calculated AB from normal and multiplying by 1.56.

Finally the formula acquires the following aspect:

1.56·pCO_2/pH -7.0/-23 x 1.56=BE mmo1/l . 2)

Thus, AB can be determined using formula 1, while BE for amniotic f1uid follows from formula2.

Such an approach enabIes to determine the amniotic fluid ABS by examining amniotic fluid pH and maternal pCO2, and to judge upon the neonatal blood ABS.

BE index=-11.5+O.2 mmol/l can be considered as normal and optimum medium for the development of natural autohybemation, while the deepening of autohybernation occurs at BE=-21.0+0.2 mmol/l and below.

Moreover, individual observation has revealed that BE below - 5.0 mmol/l is a nonoptimum autohybernation index (a so-called waking index). Therefore we think it expedient to apply an artificial hybernation in the non-optimum autohybernation incdices using cranio - cerebralhypothermia, the method by Chachava (1973), in the complex of reanimation measures.

When BE is lower than -21.0 mml/l (a deep autohybernation index: fetal hypoxia, neonatal asphyxia, prolonged labour with a weak activity) manipulations are prescribed for reanimating fetus (nalorfin may be used for neutralization of autohybernate in the complex with reanimation measures) successfully used by some authors for blocking the development of"hypoxic shock" and opiating receptors in fetus and neonate (Kintraia et al., 1985).

Thus, the problem of intranatal hybemation of fetus has a great clinical value in perinatology and obstetrics. As a result of parallel investigation of acide-base state of the blood of parturient, fetus, neonate and amniotic fluid the acidification of fetal blood and amniotic fluid was established to be the optimum medium for the autohybemation of fetus. Application of our nomogram of the ABS buffer line of amniotic fluid could help in clinical practice to asses the degree of fetal autohybemation and, in case of pathologic autohybernation, to perform the measures as indicated.

Such an approach enables to evaluate the efficiency of the conducted therapy, and rationality of labour control tactics as well as to select an optimum method of delivery.

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