ISSN: 2277- 7695
CODEN Code: PIHNBQ
ZDB-Number: 2663038-2
IC Journal No: 7725

Received: 18-01-2014
Accepted: 23-02-2014

Vol. 3 No. 1. 2014
Online Available at www.thepharmajournal.com

THE PHARMA INNOVATION - JOURNAL

A comprehensive assessment of the fetus' condition and the effectiveness of therapy in idiopathic oligohydramnios.

V.V.Malyar

1. Chair of Obstetrics and Gynecology, SHEE "Uzhhorod National University", Uzhgorod, Ukraine. [Email: dr.malyar8866@yandex.ru]

The results in the management of pregnant women in idiopathic oligohydramnios using monitoring of major parameters of the biophysical profile of the functional maternal biosystem – amniotic structures – the fetus are given in this article. It was established that prenatal prognosis could be objectively performed on the basis of the main estimations of heart rate variability, amniotic fluid index, estimations of heart rate variability, placental-fetal circulation, it's possible to choose an optimal effective therapy and medical tactics in idiopathic oligohydramnios.

Keyword: perinatal prognosis, idiopathic oligohydramnios.

1. Introduction

The decrease in birthrate, the increase in the number of disabled people from childhood – all this makes it necessary to improve support technology during the whole period of pregnancy and birth, even in healthy pregnant women [1, 4, 5].

Among the obstetric complications, there is one of the insufficiently studied issues of perinatal obstetrics – the pathology of amniotic environment, including oligohydramnios [3, 4, 6, 9].

Value of amniotic environment in the development and growth of the fetus is extremely high [4, 18]. Volume of amniotic fluid, the intensity of its metabolism, structure and its properties play an important role in the vital activity of the fetus [10, 12, 14, 16].

It is known that a complete renovation of amniotic fluid occurs every 3 hours, and the exchange of all water-soluble ingredients occurs during 5 days [4, 16, 19]. It's proved that the exchange of amniotic waters occurs both through parietal membrane and through the fetal surface of the placenta, umbilical cord epithelium, by ingestion of amniotic fluid, and in the early terms of gestation it happens also through the skin of the fetus [3, 15].

Since the appearance of fetal respiratory movements, the essential role a trachea-bronchial tree plays in the production of amniotic fluid [3].

Equally important in the regulation of amniotic fluid volume the has urinary system of the fetus, because fetal kidneys begin to function immediately after the 20th week of gestation [7].

The decrease or increase in the volume of amniotic fluid indicates significant changes in the fetoplacental system [4, 8].

Unfavorable prognostic sign – is to reduce the volume of amniotic fluid, due to the violation of the processes of its secretion and resorption [4]. It is known that oligohydramnios may occur in different terms of gestation and often remains unrecognized [4, 10].

Therefore, improvement of existing modern methods of early diagnosis, prognosis, technologies of therapeutic measures and management of pregnant women in oligohydramnios are the actual problems of modern obstetrics.

The aim of research: The purpose of this study is to reduce perinatal morbidity and mortality by improving a number of diagnostic and therapeutic measures in oligohydramnios during gestation.

2. Material and Methods: 100 pregnant women was the monitored group, who during 30-32nd week of pregnancy were diagnosed idiopathic oligohydramnios. The presence of oligohydramnios was determined on the basis of detection of diagnostic features during dynamic sonographic observation with the help of camera "Toshiba" model SAL – 38 AS (Japan).

To standardize the definition of the volume of amniotic fluid it was calculated the amniotic fluid index (AFI) according to the method of S. Phalan *et al*. (1987). Uterine cavity was divided into four squares (white line of the abdomen divides the uterus into the right and left halves, the line at level of the navel – into the upper and lower parts) and measured the vertical size of the largest pocket of amniotic fluid in each quadrant.

The sum of the four values is the amniotic fluid index (AFI). According to the classification of the volumes of amniotic fluid, if AFI is 5cm – it is oligohydramnios, 2-5 cm – moderate oligohydramnios, <2 – expressed oligohydramnios [2, 17].

Assessment of fetal urinary function, which has a direct influence on the amount of amniotic fluid [17], was performed on the basis of sonographic determination of bladder volume during of its first and repeated measurements with intervals of one hour according to the method of A.A. Polyanyn (1995) [8].

Fetal biophysical activity was determined on the basis of ultrasound examination of its respiratory (RMF) and generalized (GMF) movements, and also the assessment of muscle tone. The study of fetal respiratory movements (RMF) was performed in m-mode in longitudinal and cross sections during 30 minute ultrasound examination. Such fetal breathing movements were distinguished: single irregular, regular sporadic according to the type "inhale – exhale" (usual), double, triple, flashing (with short return to inhale during the exhale), prolonged (with the delayed exhale) and hiccup-like ("gasps"), which are characterized by the predominance of inspiration over the expiration with pronounced amplitude of the diaphragm movements.

Motor activity of the fetus was estimated according to the number and duration of generalized movements (GMF) during 30 minute-period of observation and evaluation of muscle tone. Assessment of muscle tone was based on the ability of the fetus to return to the flexion state after the movements' performance.

In order to study the objectification of motor activity of the fetus such ratios were used: index of GMF, as a percentage ratio of the total length of GMF to the time of research and index of RMF – the percentage ratio of the duration of the constant RMF to the time of the research.

Registration of fetal cardiotocogram (CTG) was performed in semi-Fowler's position performed in pregnancy on fetal monitor Sonicaid Team Care during 20 min. with the speed of the belt 1cm/min. Information on heart rate (HR) and motor activity of the fetus was filmed.

Complex assessment of the fetus' condition was performed according to the criteria of Dawes/Redman (1971) – using the automatic calculation of antenatal CTG. The presence of metabolic acidemia in fetal hypoxia was assessed by the size of STV indicator (Table 1) [13].

Investigation of the basic parameters of utero-placental and placental-fetal circulation and renal blood flow was assessed by ultrasound systems SA-8000EX (Medison, South Korea) using colour Doppler mapping and pulsed Doppler. The criteria for evaluation were circulatory numerical values of systolic-diastolic ratio (SDR), pulse jet index (PJI) and resistance index (RI).

The necessary volume of fetometry included the determining of the biparietal size of the head (BPS), femur length (FL) and the average diameter of the abdomen. Extended fetometry included: the definition of head circumference (HC) and abdomen (AC).

Table 1: The severity of fetal acidemia, depending on the size of figure STV

STV, ms	Metabolic fetal acidemia
> 4	Absence of symptoms of fetal acidemia
3,5-4,0	Initial signs of acidemia, disorder of uteroplacental and fetal-placental blood flow of the Ist degree, functional changes in the placenta
3,0-,49	Acidosis, disorder of uteroplacental and fetal-placental blood flow of the Ist and IInd degree, organic changes in the placenta
2,5-,99	Severe acidosis
< 2,5	Threat of antenatal fetal death

In determining of the fetal HC and AC the calculation formulas proposed by V.N. Demidov *et al*. (2001) were used. For HC – (BPS+FNH) x 1,57 where FNH – forehead-nape head size, but for AC – (APDA +TDA) x 1,57 where APDA and TDA – anteroposterior and transverse dimensions of the fetal abdomen.

During the observation and treatment of oligohydramnios conventional clinical laboratory tests were also performed: determination of hematocrit, electrolyte composition of blood, plasma osmolarity, urine specific gravity.

The similar study was conducted in 50 women with uncomplicated pregnancies of a term 30-32 weeks with normal amount of amniotic fluid.

Statistical analysis of the research results was carried out using modern methods of variation statistics with the help of standard statistical analysis of software Microsoft Excel 5.0.

3. Results

As a result of the examination of 100 pregnant women with mild idiopathic oligohydramnios (AFI is from 2 cm to 5 cm) in 88 (88%) cases the chronic placental insufficiency was diagnosed, and in 83 (83%) the discrepancy of major fetometric gestational age parameters, including the magnitude of the HC/AC was 1,27; and FL/AC – 0.26; which is much lower than indexes in physiological pregnancy ($p<0.005$). Of these 83 (94.3%) cases fetal distress is detected, which is confirmed by modern biophysical research methods. Performed studies have shown that groups of observation in the analysis of fetal CTG in all pregnant women basal heart rate (BHR) of fetus was 107,5±3,7 beats/min. Ruffling (undulatus) type of fetal heart rate variability was registered. There were recorded low amplitude (3,4±0,7 beats/min), moderate frequency oscillations (3,7±0,6 beats/min). In response to high amplitude spontaneous uterine contractions occurred mainly late decelerations of fetal heart rate (amplitude 34,6±3,7 beats/min, duration 47,5±4,8s). Assessment of the fetus according to the criteria of Dawes/Redman has showed signs of moderate acidemia (STV<3,5).

Sensitive indicator of the fetal condition is its moving activity. Performed studies have shown that 65% of pregnant women had been declining observation of motor activity of the fetus. The oscitancy of the fetus' returning to a state of flexion after performance of the movements also attracts attention. Compared with physiological dynamics of the pregnancy, generalized fetal movements has significantly reduced as it's evidenced by GMF index. Thus, the index of GMF was 1,8±0,3% vs 9,5±0,7% in uncomplicated pregnancy ($p<0.005$) .

Because of hypoxia centralization of blood flow in the fetus is developing, as it's evidenced by the growth of the indexes of systolic-diastolic ratio (S/D) in the umbilical artery (UA), pulsating index (PI) and resistance index (RI) to 17-20% according to the similar parameters in physiological pregnancy [1].

Thus, S/D was 3,05±0,06; PI – 1,20±0,05; RI – 1,28±0,06 ($p<0.005$). This worsened renal perfusion and decrease of fetal urine excretion 1,2

times, respectively 16,2±2,3 mg/h vs 26,7±2,4 ml/h normally ($p<0.005$). In this case, renal blood flow was characterized by pathological type of flow velocity curves (FVC), characterized by negative diastolic component in each cardiac cycle, indicating vasoconstriction of the renal vessels. This influenced the reduction of renal perfusion and excretion of urine. Thus, according to our data in AFI more than 2 cm and less than 5 cm (moderate oligohydramnios) one-hour urine excretion has decreased to 15-19 ml at a rate of 26,1±2,7 ml/h.

Development of fetal distress was characterized by a significant decrease in the index of fetal respiratory movements (FRM), which was 3,8±0,7% vs 10,7±0,8% normally ($p<0.005$). Appearance of prolonged respiratory movements by the type of some exhale delay or with a short return to the inspiration during the expiratory phase and breathing hic-cup "gasps" movements were observed; they were characterized by the predominance of inhalation over exhalation and were differentiated by expressed amplitude of the diaphragm movements. This influenced the change of the negative pressure in the interpleural cavity, secretion and release of the lung fluid into amniotic fluid, and hence the reduction of the amniotic fluid.

Our study has confirmed the fact [10] that the volume decrease of amniotic fluid greatly affects plasma osmolality of mother's blood, which in oligohydramnios is higher at 8.7% compared with physiological pregnancy 331,4±16,7 mOcm/kg H_2O vs 287,2±12,9 mOcm/kg H_2O; ($p<0.005$).

The above given data indicate that oligohydramnios is significantly associated with increased plasma osmolarity of the mother, which was a prerequisite for performance of hyperhydration of mother's organism in the genesis of idiopathic oligohydramnios using the hypotonic solution and water load within the daily liquid requirement. Hyperhydration was performed by intravenous injection of hypoosmotic solution "Ringer lactate"; theoretical osmolarity of which is 276 mOcm/kg H_2O.

Infusion of 1000 ml of "Ringer lactate" solution was conducted inversely proportional to its osmolarity, which amounted to 55-60 drops/min. During this procedure the general state of pregnant woman was observed, including blood pressure, heart rate, respiration, ECG was recorded .

Significant changes on the part of these indicators during hyperhydration were not recorded in pregnant women who were prescribed treatment.

Mother's plasma osmolarity, hematocrit, serum sodium level in the blood and hemoglobin were determined at the end of hydration.

Amniotic index was measured before and 2 hours after hydration. Determination of plasma electrolytes was performed only once during hydration to prevent potential hyponatremia and increased hemolysis.

In addition, to normalize the permeability of vessels capillary-stabilizing means was used – it's ingestion of 1 tablet of "Askorutin" 2 times a day.

In order to prevent meconial syndrome in a group of pregnant women who were found abnormal FRM, which differed by pronounced amplitude of the diaphragm movements and inhalation predominance over exhalation (type "gasps"), representing a high degree of meconial aspiration probability in the fetus [7]. We have performed measures aimed at inhibition of fetal biophysical activity in the complex treatment.

In order to reduce fetal biophysical activity using volatile mix of neurotropic drugs (1 ml of 2.5% solution of chlorpromazine and 1 ml of 0.5% solution of diazepane), diluted in 150 ml of "Ringer lactate" and injected intravenously at a speed of 0.75 ml/min.

All pregnant women in 24 hours after hydration and water load within the daily requirements, were diagnosed a significant increase in amniotic index which notably correlated with changes in plasma osmolarity during pregnancy.

Ultrasound determination of FRM has showed, that after performed complex therapy in most cases fetal biophysical activity normalized. During this the regular routine FRM were recorded, type inhale-exhale with a predominance of expiratory component promoting the secretion and outflow of the lung fluid, which plays an important role both in self-cleaning function of

the tracheobronchial tree, and in the regulation of amniotic fluid volume.

4. Conclusions

1. The main reason of moderate idiopathic oligohydramnios is chronic fetal distress as a result of chronic placental insufficiency.
2. Measurement of mother's plasma osmolarity can be a means for early diagnosis of idiopathic oligohydramnios.
3. Registration of prolonged and hic-cup "gasps" of pathological FRM indicates a high probability of meconial fetal aspiration development, due to intensive intake of amniotic fluid with impurities of meconium to the tracheobronchial tree.
4. The basic principles of treatment in idiopathic oligohydramnios are capillary-stabilizing drugs, hyperhydration of the mother's organism; and in pathological FRM is the indication for the use of volatile mixture.

5. References

1. Guginashvili NA, Sichinova LG, Gankovskaia LV. Guginashvili NA. Kliniko-patologicheskoie obosnovaniie dosrochnogo rodorazresheniia pri zaderzhke rosta ploda (Clinical-pathologic basement of early delivery in growth retardation) / // Voprosy ginekologii, akusherstva i ginekologii (Problems of gynecology, obstetrics and gynecology) 2013; 12(2):22–28.
2. Dubile P. Atlas po ultrazvukovoy diagnostike v akusherstve i ginikologii (Atlas of Ultrasound Diagnosis in Obstetrics and Gynecology) / Dubile P., Peter M., Kэrol B., Benson: Transl. from English: under the general editorship of V.E. Gazhanovoy. – 3rd ed. – Moscow: MƏDpress – genform., 2011. – 328.
3. Radzinskiy VE, Milovanov AP, Orzhanyana IM *et al*. Ekstraembrionalnyie i okoloplodnyie struktury pri normalnoy i oslozhnionnoy beremennosti (Extraembrional and amniotic structures in normal and complicated pregnancy). Moscow: Medytsynskoe informatsyonnoie agentstvo (Medical informational agency) 2004; 393.
4. Zakharov LV. Perinatalnyie ishody pri malovodii i vrozhdennyie poroki razvitiia u ploda (Perinatal outcomes in oligohydramnios and congenital defects of the fetal development) / L.V. Zakharov // Mat i ditia (Mother and child): Materialy VI Rossiyskogo foruma (Materials of the VIth Russian forum) M., 2004; 559–560.
5. Kurtser MA. Perinatalnaja smertnost i puti ieyo snizheniia (Perinatal mortality and ways of its reduction). / M.A. Kurtser // Mezhdunarodnyj meditsinskiy jurnal (International Medical Journal). 2000; 1:58–60.
6. Lobchych OA. Akusherskye i perinatalnyie aspekty malovodiya (Obstetric and Gynecological aspects of oligohydramnios) / O.A. Lobchych, V.B. Tshai // Jurnal Rossiyskogo obshchestva akusherov i ginekologov (Journal of Russian society of obstetricians and gynecologysts). 2007;1:30–31.
7. Markin LB, Koniychuk IM. Osoblyvosti fetalnoyi biofizychnoyi aktyvnosti pry vynyknenni mekonialnoyi aspiratsiyi u ploda (Peculiarities of fetal biophysical activity in meconial fetal aspiration). Visnyk naukovyh doslidzhen (Journal of Scientific Research) 2006; 2:29–30.
8. Polyanyn AA. Metod opredeleniya mochevydelitelnoy funktsii ploda i ieyo osobennosti pri pozdnem toksikoze beremennyh (Method for fetal urinary function determination and their peculiarities in late toxicosis in pregnant women). Akusherstvo i ginekologiya (Obstetrics and Gynecology). 1983; 5:55–56.
9. Sichinava LG, Goroshyna LB, Ustinova VA. Techeniye beremennosti i rodov pri malovodii (Pregnancy and delivery in oligohydramnios). Akusherstvo i ginekologiya (Obstetrics and gynecology). 2003; 2:25–28.
10. Chorna O, Orchakov O, Lytvak O. Otsinka efectyvnosti diahnostyky ta likuvannia hronichnoyi hipoksiyi ploda v razi

malovoddia u vahitnyh (Evaluation of the effectiveness of diagnosis and treatment of chronic fetal hypoxia in oligohydramnios in pregnant women). Liky Ukrayiny (Medicines of Ukraine) 2002; 10:13–14.
11. Arduini D, Rizzo G. Fetal renal artery velocity wavetorms and amniotic fluid volume in growth-retarden and post-trem fetuses. Obstet Gynecol 1991; 77:310–373.
12. Callen PW. Amniotic fluid, its role in fetal health and disease. In: Callen P.W. ed. Ulrasonography in obstrics and gynecology, 4th ed. Philadelphia: W.B. Saundres, 2000; 638–659.
13. Dawes GS, Lobb M, Moulden M *et al*. Antenatal cardiotocogram quality and interpretation using computers. British Sournal of Obstetrics and Gynaecology 1992; 99:791–797.
14. Locarelli A, Vergani P, Toso L *et al*. Perinatal oulconre associated witl oligohydramnios in uncomplicated tenn pregnancies. Arch Gynecol Obstet 2004; 269(2):130–133.
15. Nicolides KH, Peters MT, Vyas S *et al*. Relation of rate urine production to oxygen teusion in small-forgestational – age fetus. Am J Obstet Gynecol 1990; 162:387–391.
16. Sherer DM, Langer O. Oligohydramnios: use and misuse in clinical management. Ultrasound Obstet Gynecol 2001; 18:411–419.
17. Magann E, Sanderson M, Martin M *et al*. The amniotic fluid index, single pocket, and twodiameter pocketin normal human pregnancy. Am J Obstet Gynecol 2000; 182:1581-1588.
18. Magann EF, Chauhan SP, Whitworth NS *et al*. Subjective versus objective evaluation of amniotic fluid volume of pregnancies of less than 24 weers gestation. Ultrasound Med 2001; 20:191–195.
19. Marino T. Ultrasound abnormalities of the amniotic fluid membranes umbilical coard placenta. Obstetrics and Gynaecology Clinics 2004; 31:270–275.