



## CONTEMPORARY PLACENTOGRAPHY: HARM OR BENEFIT?

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Currently, pediatricians, neonatologists of maternity hospitals often take part in perinatal consultations. One of the indications for early delivery may be chronic placental insufficiency diagnosed during an ultrasound examination.

**Objective:** to evaluate the effectiveness of the main method of diagnosis of placental insufficiency at the present time – ultrasound evaluation of the placenta. **Materials and methods.** An analysis was made of 357 birth histories, exchange cards, protocols for screening ultrasound in the third trimester of pregnancy and conclusions of pathoanatomical investigation. **Results.** To substantiate the need for prenatal diagnosis of chronic kidney disease, a comparison was made of the evaluation of newborn babies on the Apgar scale and the state of the placenta according to histological data. With compensated chronic placental insufficiency, there was no difference in Apgar scores at the first and fifth minutes, whereas in the subcompensated stage, Apgar score on the Apgar scale was significantly lower in the first and fifth minutes than in the control group. To identify possible in practical use of the objective parameters of diagnosis of chronic kidney disease, the thickness of the placenta was measured during the screening ultrasound in the third trimester of pregnancy, as well as the thickness of the placenta after its separation. Significant differences in the thickness of the placenta or in the screening ultrasound, or when measuring the placenta after separation in patients with and without chronic placental insufficiency was not detected. When assessing a violation of the rate of maturation of the placenta in the third trimester of pregnancy, no significant differences were found in the presence and absence of placental insufficiency. An analysis of the amniotic index was carried out to determine the amount of amniotic fluid in patients of the main and control groups, which revealed no significant differences between the groups. **Conclusions.** The authors believe that the main indicators currently used for diagnosis of chronic placental insufficiency (thickness of the placenta, degree of maturity of the placenta, appearance of structural changes in the placenta, change in the amount of amniotic fluid) are uninformative and modern placenography does more harm than benefit. The only parameter determined during the screening study in the third trimester of pregnancy and having significant differences in the main and control groups is fetal hypotrophy.

**Keywords:** pregnancy; placental insufficiency; trimester of pregnancy third; Apgar score; prenatal diagnosis.

## СОВРЕМЕННАЯ ПЛАЦЕНТОГРАФИЯ: ВРЕД ИЛИ ПОЛЬЗА?

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В настоящее время педиатры, неонатологи родильных домов зачастую становятся участниками перинатальных консилиумов. Одним из показаний к досрочному родоразрешению может быть хроническая плацентарная недостаточность, диагностированная во время ультразвукового исследования.

**Цель исследования** – дать оценку эффективности ультразвукового исследования плаценты, являющегося основным методом диагностики хронической плацентарной недостаточности в настоящее время. **Материалы и методы.** Был проведен анализ 357 историй родов, обменных карт, протоколов скринингового ультразвукового исследования в третьем триместре беременности и заключений патолого-анатомического исследования последов. **Результаты исследования.** Для обоснования необходимости дородовой диагностики хронической плацентарной недостаточности провели сравнение оценки новорожденных по шкале Апгар и состояния плаценты по данным гистологического исследования. При компенсированной хронической плацентарной недостаточности различия в оценке по шкале Апгар на 1-й и 5-й минутах не обнаружены, тогда как при субкомпенсированной стадии аналогичная оценка новорожденных достоверно ниже, чем в контрольной группе. Для выявления возможных в практическом использовании объективных параметров постановки диагноза «хроническая плацентарная недостаточность» была проанализирована толщина плаценты при измерении во время скринингового ультразвукового исследования в третьем триместре беременности, а также толщина плаценты после ее отделения. Достоверного различия в толщине плаценты ни при скрининговом ультразвуковом исследовании, ни при измерении плаценты после отделения у пациенток при наличии и отсутствии хронической плацентарной недостаточности не выявлено. При оценке нарушения темпов созревания плаценты в третьем триместре беременности также не было отмечено достоверных различий при наличии и отсутствии плацентарной недостаточности. Был проведен анализ измерения амниотического индекса для определения количества околоплодных вод у пациенток основной и контрольной групп, который не показал достоверных различий между группами. **Выводы.** Авторы полагают, что основные параметры, используемые в настоящее время для постановки диагноза «хроническая плацентарная недостаточность» (толщина плаценты, степень зрелости плаценты, появление структурных изменений в плаценте, изменение количества околоплодных вод), малоинформативны и современная плацентография приносит скорее вред, чем пользу. Единственный показатель, определяемый во время скринингового исследования в третьем триместре беременности и имеющий достоверные различия в основной и контрольной группах – гипотрофия плода.

**Ключевые слова:** беременность; плацентарная недостаточность; триместр беременности третий; оценка Апгар; пренатальная диагностика.

Paediatricians and neonatologists in maternity hospitals often participate in perinatal consultations. This is regulated by the order of the Ministry of Health of Russia No. 457 of 28th of December, 2000, 'On the improvement of prenatal diagnosis in the prevention of diseases in children' (in coordination with the 'Instructions for organizing prenatal examination of pregnant women with the aim of detecting congenital and hereditary abnormalities in the foetus', 'Instruction for the invasive diagnosis of the foetus and genetic studies of cell biopsies' and 'Instructions for the verification of the diagnosis after the pregnancy termination for medical reasons or the birth of a child after an invasive diagnosis'). Neonatologists should be actively involved in these consultations because they have to know the indications for early termination of pregnancy, be familiar with the causes of the diagnosis of a pathological condition and understand the possible complications for a newborn. One of the possible causes of early delivery, usually operative, or termination of pregnancy is chronic placental insufficiency, which, according to various studies, in 25%–77% of cases [1, 5, 7, 10] can be accompanied by hypoxia, foetal growth retardation and increased perinatal morbidity and mortality (up to 60%) [1, 10, 11]. The placentography technique is described and is significantly used in placental insufficiency diagnosis [1–4, 6, 8, 9, 12].

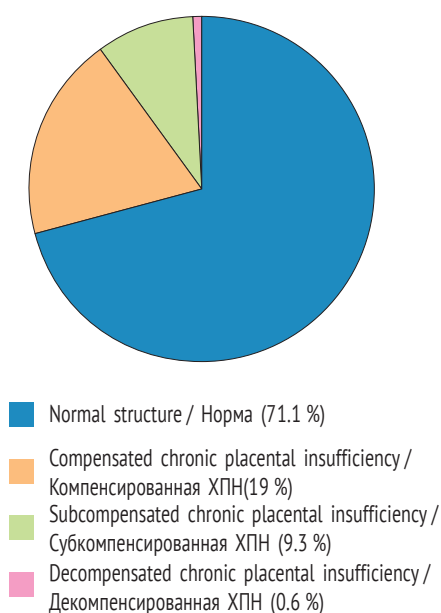
*The study aimed to assess the effectiveness of placentography as the standard diagnostic method of placental insufficiency.*

## MATERIALS AND METHODS

Analysis was done on 357 labour and delivery records, exchange cards, third trimester ultrasound screening protocols and pathoanatomical findings of the placenta conducted at the Leningrad Regional Pathological and Anatomical Bureau (LRPAB). The patients were grouped into two according to histological structure of the placenta. The study group consisted of patients with placenta characterized by chronic placental insufficiency (CPI) while the control group included patients with placenta characterized by a normal structure with reactive, compensatory-reactive and involutive changes. The study group patients were further divided into subgroups depending on the CPI stage, which could be compensated, subcompensated and decompensated. Normal placental tissue was noted in 254 (71%) women, whereas 103 (29%) patients showed CPI. Figure 1 presents the histological structure of the placenta in the study group.

## STUDY RESULTS

In Russia, the condition of the child after birth and the need for resuscitation are assessed during



**Fig. 1. Histological structure of the placenta in the study group. CPI – chronic placental insufficiency**

**Рис. 1. Гистологическое строение плаценты в группе исследования. ХПН – хроническая плацентарная недостаточность**

the first and fifth minutes of extrauterine existence using the Apgar scale (Table 1).

The Apgar score at the first and fifth minutes in full-term newborns is significantly lower in patients with CPI than in those with normal placenta structure. Moreover, a clear correlation between the Apgar score and the stage of the pathological process in the placenta was reported. Comparing newborns in the control group with those in the group with compensated CPI, no differences in the Apgar score at the first and fifth minutes were observed, whereas newborns of the subcompensated stage group showed

lower Apgar scores at the first and fifth minutes than those in the control group. In patients with decompensated placental insufficiency, the newborn Apgar score is also significantly lower (even with the small number of samples).

Hence, the condition of the newborn is affected not solely and not so much by placental insufficiency but also by the pathological process stage. In this case, compensated placental insufficiency should be considered as an acceptable structure of the placenta with the implementation of compensatory-adaptive mechanisms on the part of the mother, foetus and

*Table 1 / Таблица 1*

Apgar score on 1 and 5 minutes of newborns of the main and control groups

Оценка по шкале Апгар на первой и пятой минутах новорожденных основной и контрольной групп

Comparison groups / Группы сравнения	Apgar score / Оценка по шкале Апгар		Significance of differences ( <i>p</i> ) / Достоверность различий ( <i>p</i> )
	on 1 minutes / минута 1	on 5 minutes / минута 5	
Main group / Основная группа ( <i>n</i> = 103)	7.69 ± 0.63 (5–8)	8.7 ± 0.59 (6–9)	< 0.001
• compensated / компенсированная	7.76 ± 0.55 (5–8)	8.76 ± 0.55 (6–9)	> 0.05
• subcompensated / субкомпенсированная	7.58 ± 0.72 (5–8)	8.61 ± 0.62 (7–9)	< 0.001
• decompensated / декомпенсированная	7 (6–8)	8 (7–9)	< 0.001
Control group / Контрольная группа ( <i>n</i> = 254)	7.9 ± 0.35 (7–9)	8.9 ± 0.36 (8–10)	1

placenta. Thus, for effective pregnancy and child-birth management, it is essential to develop criteria, in particular those based on ultrasound results, for the timely identification of subcompensated and decompensated stages of placental insufficiency during pregnancy.

Ultrasound examination in the third trimester of pregnancy includes evaluation of the placental thickness, which is found to be a reliable CPI indicator and can be accurately measured during a pathoanatomical examination of the placenta. The placental thickness determined after birth was compared. The measurement was included in the evaluation and reflected in the protocol. Table 2 shows the results obtained.

There were no significant differences detected between the placental thickness in full-term infants and the normal structure of the placenta with CPI.

The prenatal placental thickness at 30–34 week's gestation was evaluated during the third foetal screen-

ing and did not reveal significant differences in the study and control groups (Table 3).

Placental maturity grade and structural features were determined on ultrasound (the presence of calcifications and intervillous spaces extensions, urinary tracts), and intrauterine growth restriction and circulatory failure were assessed using Doppler velocimetry. The findings are presented in Tables 4–6. Incidences of any structural changes in the placenta, including calcium deposits, fibrinoid salts and extension of urinary tracts (see Table 5) were not reported in the normal and with CPI groups. Furthermore, extension of the urinary tract was more common in the normal placental structure than with placental insufficiency. The differences were not significant. Accordingly, calcium salt and fibrinoid deposits and urinary tract extension are parameters of the structure and function of the placenta, not the manifestations of CPI.

Abnormalities in the amount of amniotic fluid are significant indicators of congenital malformations,

Table 2 / Таблица 2

The thickness of the placenta in full-term infants

Толщина плаценты у доношенных новорожденных

Comparison groups / Группы сравнения	The thickness of the placenta, mm / Толщина плаценты, мм	Significance of differences (p) / Достоверность различия (p)
Main group / Основная группа (n = 103)	20.49 ± 4.79	> 0.05
• compensated/ компенсированная	20.42 ± 4.04	> 0.05
• subcompensated / субкомпенсированная	21.1 ± 5.4	> 0.05
Control group / Контрольная группа (n = 254)	20.19 ± 4.84	1

Table 3 / Таблица 3

The thickness of the placenta with a screening ultrasound at 32–34 weeks

Толщина плаценты при скрининговом ультразвуковом исследовании в 32–34 недели

Comparison groups / Группы сравнения	The thickness of the placenta at 32–34 weeks of gestation, mm / Толщина плаценты в 32–34 недели, мм	Significance of differences (p) / Достоверность различия (p)
Main group / Основная группа (n = 103)	32.71 ± 4.36 (24–46)	> 0.05
• compensated/ компенсированная	32.74 ± 4.45 (25–46)	> 0.05
• subcompensated / субкомпенсированная	32.87 ± 3.55 (24–43)	> 0.05
• decompensated / декомпенсированная	28	> 0.05
Control group / Контрольная группа (n = 254)	33.42 ± 3.27 (26–41)	1

Table 4 / Таблица 4

The degree of maturity of the placenta (Grannum), as determined by screening ultrasound in the third trimester of pregnancy

Степень зрелости плаценты (по Grannum), определенная при скрининговом ультразвуковом исследовании в третьем триместре беременности

Comparison groups / Группы сравнения	The degree of maturity of the placenta / Степень зрелости плаценты		
	Delayed / Отстает	Forestall / Опережает	Significance of differences (p) / Достоверность различия (p)
Main group / Основная группа (n = 103)	1 (0.28 %)	13 (3.64 %)	> 0.05
• compensated/ компенсированная	1 (0.28 %)	7 (2.96 %)	> 0.05
• subcompensated / субкомпенсированная	–	6 (1.68 %)	> 0.05
• decompensated / декомпенсированная	–	–	> 0.05
Control group / Контрольная группа (n = 254)	2 (0.56 %)	19 (5.32 %)	1

Table 5 / Таблица 5

Features of the structure of the placenta in the screening study in the third trimester of pregnancy

Особенности строения плаценты при скрининговом исследовании в третьем триместре беременности

Comparison groups / Группы сравнения	Features of the structure of the placenta / Особенности строения плаценты					
	Fibrinoid / Фибриноид	Significance of differences (p) / Достоверность различия (p)	Calcificates / Кальцинаты	Significance of differences (p) / Достоверность различия (p)	Extensions of intervillous spaces / Расширения МВП	Significance of differences (p) / Достоверность различия (p)
Main group / Основная группа (n = 103)	3 (0,84 %)	> 0,05	2 (0,56 %)	> 0,05	4 (1,1 %)	> 0,05
• compensated/ компенсированная	1 (0.28 %)	> 0.05	2 (0.56 %)	> 0.05	2 (0.56 %)	> 0.05
• subcompensated / субкомпенсированная	2 (0.56 %)	> 0.05	–	–	2 (0.56 %)	> 0.05
Control group / Конт- рольная группа (n = 254)	5 (1.4 %)	1	3 (0.84 %)	1	11 (3.1 %)	1

Note. intervillous spaces.

Примечание. МВП — межворсинковые пространства.

and it is necessary to initially exclude these anomalies. As for CPI, there were no reported significant differences in the amount of amniotic fluid (amniotic index) in normal and pathological conditions. The data are presented in Table 6.

Polyhydramnios was noted in the normal placenta and could be due to an infectious lesion in the placenta. This study also aimed to assess the effects of infectious lesion on the normal placenta. It is likely that the amount of amniotic fluid increases in compensated placental insufficiency, while it decreases during the transition of compensated placental insufficiency to a subcompensated stage, but any significant difference was not noted in this study.

iciency to a subcompensated stage, but any significant difference was not noted in this study.

Much attention in practical obstetrics and prenatal ultrasound diagnostics is given to determine placental maturity grade. This indicator is one of the main criteria for CPI diagnosis, especially in a premature placenta. However, in this study, no difference was detected in the placental maturity grade with the normal histological structure and CPI (Table 4).

The two determined main indicators for early delivery were circulatory failure and foetal malnutrition based on ultrasound findings. Intrauterine growth

Table 6 / Таблица 6

Changes in the amount of amniotic fluid during screening ultrasound in the third trimester of pregnancy  
Изменения количества околоплодных вод во время скринингового УЗИ в третьем триместре беременности

Comparison groups / Группы сравнения	Amniotic index, cm / Амниотический индекс, см	Significance of differences (p) / Достоверность различия (p)	Polywater / Многоводие	Lack of water / Маловодие	Significance of differences (p) / Достоверность различия (p)
Main group / Основная группа (n = 103)	15.68 ± 3.8	> 0.05	7 (1.96 %)	3 (0.84 %)	> 0.05
• compensated/ компенсированная	16.23 ± 3.47	> 0.05	5 (1.4 %)	–	> 0.05
• subcompensated / субкомпенсированная	14.76 ± 4.31	> 0.05	2 (0.56 %)	2 (0.84 %)	> 0.05
• decompensated / декомпенсированная	14	> 0.05	–	–	–
Control group / Контроль- ная группа (n = 254)	15.96 ± 3.25	1	9 (2.52 %)	1 (0.28 %)	1

restriction (foetal malnutrition) was determined using the standard ultrasound fetometry (measuring the biparietal size of the head and its circumference, average diameter and circumference of the abdomen and length of the femur and humerus). If the sizes were less by two or more weeks, the patients were characterized as symmetric (uniform lag in all sizes) or asymmetric (predominant lag in one size) hypotrophy. Circulatory failure was diagnosed by the presence of impaired blood flow in the umbilical and uterine arteries. According to the obtained data, foetal malnutrition is more often noted in patients with CPI, while circulatory failure does not directly associated with the presence of this pathology and occurs with equal frequency in both normal and pathological structure of the placenta (Table 7).

Thus, this study did not include data on the difference of ultrasonic markers of placental insufficiency, such as thickness, maturity grade, structural features of the placenta, amniotic fluid amount and circulatory failure, which many studies refer to in diagnosing this condition [2, 4, 6, 8, 12]. The only identified CPI indicator is foetal malnutrition, which occurs during the subcompensated stage of placental insufficiency. In identifying small-for-date foetus, necessary examinations include cardiotocography and Doppler assessment of blood flow in the ductus venosus for early detection of critical abnormalities in foetal conditions and timely delivery.

Neonatologist participating in a perinatal consultation should understand that CPI is a serious complication of pregnancy, increasing the frequency of

newborns requiring resuscitation and in a state of hypoxia. In addition, diagnostic criteria using ultrasound of CPI are imperfect and uninformative, resulting in an unevidenced diagnosis of this condition and, possibly, polypharmacy and early delivery. Delay in the development rate is an indicator of foetal intrauterine development abnormality. It must be closely monitored when establishing a labour management plan and planning resuscitation measures.

## FINDINGS

1. The parameters determined by placentography (placental thickness, maturity grade and structural features) and the amount of amniotic fluid do not differ in the presence and absence of placental insufficiency.

2. Circulatory failure, which is determined through blood flow analysis in the umbilical and uterine arteries, does not significantly differ in the study and control groups.

3. Foetal malnutrition is the only determined indicator for CPI, evaluated during ultrasound examination in the third trimester of pregnancy.

4. The current standard method for the diagnosis of placental insufficiency is ultrasound examination in the third trimester of pregnancy. It is uninformative and does more harm than good.

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Table 7 / Таблица 7

Circulatory failure and malnutrition of the fetus during screening ultrasound in the third trimester of pregnancy  
Недостаточность кровообращения и гипотрофия плода во время скринингового УЗИ в третьем триместре беременности

Comparison groups / Группы сравнения	Circulatory failure / Недостаточность кровообращения	Significance of differences (p) / Достоверность различия (p)	Fetus malnutrition / Гипотрофия плода	Significance of differences (p) / Достоверность различия (p)
Main group / Основная группа (n = 103)	2 (0.65 %)	> 0.05	12 (3.36 %)	< 0.01
• compensated / компенсированная	2 (0.65 %)	> 0.05	2 (0.56 %)	> 0.05
• sub- and decompensated / суб- и декомпенсированная	0	–	10 (2.8 %)	< 0.01
Control group / Контрольная группа (n = 254)	5 (1.4 %)	1	5 (1.4 %)	1

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