

# Obstetric cardiology: what's new in the XXI century

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In the article it has been analyzed the up-to-date achievements and the best practices in providing perinatal care to obstetrical/pregnant patients with congenital and evoked heart diseases, as well as integration of global and local practices in obstetric cardiology. There are underlined the main risk factors and peculiarities of managing pregnancy complicated by congenital and acquired heart diseases, and cancer. It has been concluded that such women are in need of a thorough preconception/pre-pregnancy care, as well as further treatment by a multidisciplinary team of the highly skilled doctors during pregnancy. Furthermore, practical medicine needs an actual risk index (nowadays, scales rating risk factors) of serious cardiac events in pregnant women with heart diseases (CARPREG and NYHA), as well as the introduction of intensity markers for heart failure (BNP and NT-proBNP), which provide significant improvement in perinatal cardiac outcomes in the treatment of high risk patients.

**Key words:** obstetric cardiology, heart diseases, pregnancy, heart failure, cardiac event.

**Background.** According to the recent data approximately 0.8% of children are born with an abnormality of the heart and blood vessels worldwide. It should be emphasized that thirty years ago to 80% of these children died in infancy, and in the last two decades of achievements of medicine have allowed to live to adulthood 85% of these children [2, 5, 7, 12].

**The main target** of this publication is to analyze the existing achievements and best practices in perinatal care for women with congenital and acquired heart diseases.

**Results.** The majority of physicians and scientists insist that even the successful implementation of radical surgery on the heart does not specify a full recovery, as in the heart or blood vessels remains a scar that results in greater susceptibility to infections, development of arrhythmias, so there is an additional risk factor for pregnancy, childbirth and course of the postpartum period [2, 5, 7, 12].

Several researchers have reached a consensus that for the proper organization of perinatal care for women with operated and non-operated congenital heart diseases (CHD) is extremely important to establish the continuity of follow-up for those women from childhood to adult by multidisciplinary approach of specialists in cardio-vascular surgery, cardiology, family medicine and obstetrics and gynecology [2, 5, 7, 12].

It's absolutely obvious, that the perinatal management of cardiac patients who are or plan to become pregnant is a complex and challenging field. Even in women without any significant somatic pathology the pregnancy course is relatively individual, but in case of pregnancy and CHD physicians often have limited experience [4, 7].

Moreover, clinical trials in pregnant women with CHD are few and vary by group phenotype, it's necessary to understand, that appropriate randomized trials are practically absent. In the available literature it's possible to reveal the results of experience in the form of single or multiple case reports, single-institution data, registries, and opinions of the authors who specialize

in this field [2, 4, 5, 7, 12]. This situation existed in the end of the XX century.

At the beginning of XXI century the concept of grown up congenital heart disease (GUCH) was established and the special departments (GUCH unit cares) were organized for patients who have been born with CHD required surgery shortly or in some terms after birth. In these GUCH units the special care and support has been given for patients with acquired heart pathology, for patients who have had heart infections which have led to a deterioration of the heart structure and function. The same approach in USA was named Adult with CHD (ACHD) [9–11].

Analysis of existent data revealed that during the 2000–2010 there was a new approach to establish the advanced perinatal care for GUCH patients: multi-centers studies with multivariate modeling, refinement of heart and vascular lesion specific risks, links between cardiovascular (CV), obstetric and fetoneonatal events. There were several studies which allowed to recommend the special scales of maternal cardiovascular risks as well for evaluation of fetoneonatal risks (table 1, 2) [5, 7, 12].

During this period the specified risk scores have been proposed in order to evaluate the global cardiac risk of pregnancy for women with heart diseases. The original risk score has been proposed by a Canadian consortium (CARPREG risk score) is based on 4 risk predictors:

- 1) poor functional status (NYHA class > II) or cyanosis,
- 2) systemic (left) ventricular systolic dysfunction,
- 3) left heart obstruction,
- 4) history of prior cardiac events (arrhythmia, stroke, heart failure).

Each predictor was assigned by one point. So, the pregnant with 0 predictors were stratified at low risk (5%), patients with 1 predictor – at intermediate risk (25%) and those with >1 predictor was at high risk (75%) of adverse cardiac events during pregnancy [12].

The risk score by Khairy et al included right ventricular systolic dysfunction and/or severe pulmonary regurgitation into the

Table 1

Maternal Predictors of Neonatal Events

	OR	95% CI	P
Univariate predictor			
Oxygen saturation (per 1% decrease)	2.1	1.1, 4.1	0.0322
Smoking history	8.0	1.4, 45.6	0.0191
Subaortic ventricular outflow tract gradient, mm Hg	1.03	1.01, 1.06	0.0139
Gradient >30 mm Hg	5.3	1.3, 21.7	0.0220
Symptomatic arrhythmia during pregnancy	5.2	1.1, 24.5	0.0360
Multivariate predictor			
Subaortic ventricular outflow tract gradient >30 mm Hg	7.5	1.5, 37.6	0.0147

**CARPREG and ZAHARA prediction models CARPREG predictors of maternal complications (points)  
Fetal complications (both models)**

CARPREG predictors of maternal complications (points)	Fetal complications (both models)	ZAHARA predictors of maternal complications (points)
Prior cardiac event: heart failure, transient ischemic attack, stroke, or arrhythmia	^	History of arrhythmia
NYHA class >II or cyanosis	^	Cyanosis (1.0) NYHA class II (0.75)
Maternal left heart obstruction: MVA G2 cm <sup>2</sup> , AVA G1.5 cm <sup>2</sup> , peak LVoutflow gradient >30 mm Hg (1)	^	Aortic/left ventricular outflow gradient >50 mm Hg or aortic valve area G1.0 cm <sup>2</sup> (2.50)
Systemic ventricle ejection fraction <0.40 (1)	-	-
Smoking during pregnancy (-)	^	^
Use of anticoagulants (-)	^	-
Multiple gestations (-)	^	-
Mechanical valve prosthesis (-)	^	(4.25)
Use of cardiac medications prepregnancy (-)	-	(1.50)
Moderate-severe subpulmonary atrioventricular valve regurgitation (-)	-	(0.75)
Moderate-severe systemic atrioventricular valve regurgitation (-)	-	(0.75)

-, Not directly addressed or influenced or no data provided; AVA, aortic valve area; CARPREG, CARdiac disease in PREGnancy; LV, left ventricular; MVA, mitral valve area; NYHA, New York Heart Association functional class; ZAHARA, Zwangerschap bij Aangeboren HARTafwijkingen.

CARPREG risk score. The most recent risk score from the ZAHARA investigators is a integrative scoring system and includes a number of new factors into the risk prediction model including:

- a) cardiac medications before pregnancy,
- b) systemic atrioventricular regurgitation
- c) mechanical valve prosthesis [2].

The comprehensive unified scoring systems allowed to compare the data from different countries and institutions. It's necessary to emphasize, that during last four years the further development of globalization in obstetric cardiology is been observed: transnational collaboration targeted on the risk classification modification, evaluation of the impact of the low socioeconomic status on the efficiency of the care, new approaches for the refinement of risk prediction. The main steps were: the publication of ESC Guidelines for management of cardiovascular pathology in pregnancy (2011), RCOG Heart Disease and Pregnancy – study group statement (Consensus views arising from the 51st Study Group: Heart Disease and Pregnancy) (2002, revised 2010) [5, 9–11].

During last five years the attention of specialists in obstetric cardiology was drawn to issues of consequences of specific adjuvant and neo-adjuvant therapy of several malignancies for heart structure and function. The cardiotoxicity of medications (e.g. anthracycline) used for treatment of Non-Hodgkins, Hodgkins lymphoma, chronic lymphocytic lymphoma results in possible CV systolic and diastolic dysfunction, late onset of chronic heart failure, arrhythmias, sudden death. Those risks are enhanced by the combined radiation of the chest zone [8].

During last two decades the experience of Trastuzumab (Herceptin) implementation in the treatment of breast cancer (HER-2/neu positive) has been analyzed. As for the perinatal management, besides the prompt oncology consequences, it is necessary to take into consideration its cardiotoxicity. The available data testify about the risk of cardiac dysfunction (3–4%), asymptomatic cardiac dysfunction (5–20%), congestive heart failure (2%). Moreover, there is the limited experience during pregnancy, but the authors discuss the possible effects on the amniotic fluid and on the fertility [1, 3, 6].

**Outcomes.** The data obtained in the analysis of the existing experience resulted in the following re-considerations of the perinatal care for GUCH patients and patients with acquired heart and

vascular pathology in the Department of Obstetric Issues in High Risk Pregnancy (Head of Department-Iu.Davydova, MD, PhD, MPA). The reconsiderations concerned the modification of risk stratification (by means of CarPreg risk score use), use of predictive value of B-type natriuretic peptide (BNP) and N-terminal fragment of the prohormone B-type natriuretic peptide ( NT-proBNP) in the beginning and mid-pregnancy in order to clarify the group of GUCH patients who would may have the preterm planned delivery. The most significant achievement was the establishing of multidisciplinary approach by team of specialists in cardiology and vascular surgery, interventional cardiology, heart and vessels imaging (including MRI, CT, EchoCG), cardiology, the obstetricians of the abovementioned department.

The main principles of ESC Guidelines for management of cardiovascular pathology in pregnancy are also considered in the routine perinatal care for GUCH patients and women with acquired heart and vascular diseases.

According to the evidence that the pregnant patients with newly diagnosed oncology pathology as well as with the history of complex treatment of malignancies are being transferred to our department the following additional criteria were stated: BNP, NT-proBNP, troponin, EchoCG for all the women, who had radiology treatment for chest zone, antracyclines before and during pregnancy.

**Key note. The predictors of predictors of increased risk of cardiac complications during pregnancy**

1. Poor functional status (NYHA functional class > II)
2. Cyanosis (oxygen saturation at rest < 90%)
3. Left ventricular systolic dysfunction (ejection fraction < 40%)
4. Right ventricular systolic dysfunction and/or severe pulmonary regurgitation
5. Moderate or severe systemic atrioventricular valve regurgitation
6. Moderate or severe pulmonary atrioventricular valve regurgitation
7. Left heart obstruction
8. Mechanical valve prosthesis
9. History of cardiac events prior to pregnancy (arrhythmia, pulmonary edema or stroke)

**Акушерская кардиология: что нового в XXI веке**  
**Ю.В. Давыдова, А.А. Огородник, Л.П. Бутенко**

В статье проведен анализ существующих достижений и передового опыта в оказании перинатальной помощи беременным с врожденными и приобретенными пороками сердца, а также интеграция международного и отечественного опыта в области акушерской кардиологии. Изложены основные факторы риска и особенности менеджмента вынашивания беременности при врожденных и приобретенных пороках сердца, а также у беременных с онкологической патологией. Сделаны выводы о необходимости тщательной подготовки такой группы женщин к беременности и участия мультидисциплинарной команды с включением всех необходимых высокоспециализированных специалистов во время беременности. Также необходимым является внедрение в практическую медицину современных шкал оценки степени риска серьезных сердечных событий при беременности и сердечной недостаточности (СН) (CARPREG и NYHA), а также маркеров степени выраженности СН (BNP и NT-proBNP), что позволяет значительно улучшить перинатальные и кардиальные исходы у беременных из группы высокой степени риска.

**Ключевые слова:** акушерская кардиология, сердечно-сосудистые заболевания, беременность, сердечная недостаточность, сердечные события.

**Акушерська кардіологія: що нового в XXI столітті**  
**Ю.В. Давидова, А.А. Огородник, Л.П. Бутенко**

У статті проведено аналіз існуючих досягнень і передового досвіду в наданні перинатальної допомоги вагітним з уродженими і набутими вадами серця, а також інтеграція міжнародного та вітчизняного досвіду в галузі акушерської кардіології. Наведено основні фактори ризику та особливості менеджменту виношування вагітності при вроджених і набутих вадах серця, а також у вагітних з онкологічною патологією. Зроблено висновки про необхідність ретельної підготовки такої групи жінок до вагітності та участі мультидисциплінарної команди з включенням усіх необхідних високоспеціалізованих фахівців під час вагітності. Також необхідним є впровадження в практичну медицину сучасних шкал оцінки ступеня ризику серйозних серцевих подій при вагітності та серцевої недостатності (СН) (CARPREG і NYHA), а також маркерів ступеня вираженості СН (BNP і NT-proBNP), що дозволяє значно поліпшити перинатальні та кардіальні наслідки у вагітних з групи високого ступеня ризику.

**Ключові слова:** акушерська кардіологія, серцево-судинні захворювання, вагітність, серцева недостатність, серцеві події.

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