OUR EXPERIENCE OF ULTRASOUND DIAGNOSIS OF CONGENITAL HEART DISEASES

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ABSTRACT — Congenital heart disease (CHD) is the most common disorder of newborns.Most forms of CHD can be detected in utero, especially the severe ones with considerable fetal and postnatal morbility and mortality. Although there has been a great improvement in the diagnosis of CHD both prenatally and postnatally due to the availability of echocardiograpy. The goals of fetal echocardiograpyare to exclude CHD and, when present, to diagnose the specific malformations of the heart.

We report about 2392 cases of fetus's CHD during an period between 2012–2014 years. All cases were verified. Most of them were severe CHD. The number of diagnostic mistakes is 81 (3,4%) from 2392 cases. Echocardiography reveals major congenital heart diseases with a high of accuracy (the number of diagnostic mistakes is 3,4%). Ultrasound of fetus's heart will determine whether the fetus has the type of structural abnormality and detaliesspecifical CHD. This information is very important for choice of surgical repair after birth.

Congenital heart disease (CHD) is the most common disorder of newborns, affecting one out of every 100 babies. CHD is 6 times more common than chromosomal abnormalities and 4 times more common than neural tube defects [3].

About 25% of all infant deaths resulting are due to congenital malformations and one third of these deaths are of infants with cardiac abnormalities. Most forms of CHD can be detected in utero, especially the severe ones with considerable fetal and postnatal morbility and mortality.The prenatal diagnosis of major CHD requires furtherassessment for extracardiac (about 65%) and chromosomal (about 43%) abnormalities [1,2].

Although there has been a great improvement in the diagnosis of CHD both prenatally and postnatally due to the availability of echocardiograpy. The goals of fetal echocardiograpyare to exclude CHD and, when present, to diagnose the specific malformations of the heart. Echocardiography will determine whether the fetus has the type of structural abnormality and detaliesspecifical CHD. This information is very important for choice ofsurgical repair after birth.

THE STAGES OF FETAL ECHO

The early transvaginal fetal echocardiogram can be performed at 12 weeks of pregnancy (for exclude major heart malformations for groups of risk.). But early transvaginal fetal diagnosis will be repeat over 2 weeks. The optimal transabdominal fetal echocardiogram can be performed at 16 to 22 weeks of pregnancy. By this time , details of the fetal cardiac anatomy can be well visualized, such as the atrioventricular and ventriculoarterial connections.

Fetal echocardiographic images may be difficult after 32–34th weeks of gestation because of fetal rib shadowing, fetal position, or maternal body habitus.

METHODS OF SCREENING OF MAJOR FETAL HEART ANOMALIES

Definition of fetal CHD was attempted from multiple scan planes including four-chamber, long- and short-axis as well as aortic arch and ductal arch views. We use 3–4 Dimensional Fetal Echocardiograms for diagnosis complex CHD after 2 dimensional echo. Optimal 3-Dimensional Fetal Echocardiograms were obtainedbetween 22 and 27 weeks

of gestation. 3-D echocardiography enables more detailed evaluation of dynamic fetal cardiac function.

Doppler color flow mapping and pulsed Doppler interrogation were used to facilitate identification of great vessel relationship, location and severity of ventricular outflow obstruction. Initial fetal echocardiograms were obtained between12 and 39 weeks of gestation (median 24.5 weeks). Major cardiac malformations should be followed serially by fetal echocardiography as progressive alterations in flow may affect growth of cardiac structures over time: for example, very often, after prenatal diagnosis of hypoplastic left-heart syndrome (HLHS) couples have been offered termination of pregnancy.

But termination of pregnancy should not be proposed when it is only a small left ventricle (on echo), because many of those patients end up with only coarctation of the aorta. A second echo should be carried out in these cases.

Methods of the echocardiographic identification of fetal CHD are:

— postnatal echocardiography,
— angiography,
— surgery or autopsy.

RESULTS

A total of 2392 fetuses were obtained during an period between 2012–2014 years with a prenatal diagnosis of CHD were enrolled.

CHD usually are diagnosed during the first echo.

The number of echocardiographic studies was ranging from one to four examinations. Maternal age was from 17 to 41 years old.

— 29 % of fetal echocardiograms were obtained before 18 weeks of gestation.
— 48% of fetal echocardiograms were obtained between 18–28 weeks of gestation.
— 23% of fetal echocardiograms were obtained between 29–39 weeks of gestation.

The number of diagnostic mistakes is 81 (3,4%) from 2392 cases. The results of our patient's cohort are presented in tables 1, 2.

DISCUSSION

Fetal echocardiography has opportunity to study the most important parameters of fetal heart with major congenital defects for postnatal surgical repair.

Important parameters of fetal echocardiography in last weeks (32–34 weeks of gestation) are:

— left/right ventricular diastolic dimensions in M-mode, B-mode (right–to–left ventricular disproportion: cardiomegaly, dilatation of right ventricle, right atrium or left chambers of heart; hypoplastic right or left heart);
— atrioventricular and semilunar valves'sdimentions (valve's stenosis/atresia or dilatation);
— study of ejection fraction (fetal heart contractility including its ability to fill and to eject blood to the body and back to the placenta);
— inefficient of fetal circulatory (pericardial effusion, atrioventricular regurgitation, fetal non-immune hydrops, fetal arrhythmias;
— ultrasound diagnosis of anatomical details of specific CHD.

ULTRASOUND DETAILS FOR SPECIFIC CHD BY THE PLANNING OF THE DELIVERY AND THE POSTNATAL CARE

Most important Ultrasound details for major CHD are:

ForConotruncal anomalies (fig. 1, 2):

— fetal echocardiographic definition of the great artery relationship;
— left ventricular diastolic dimension;
— dimension of foramen ovale (restrictive foramen ovale-early closure of a flap valve in the fetal heart and restriction of flow across the foramen ovale);
— dimension of ductusarteriosus (duct closures);
— type ofcoronary arteries;
— the location of associated ventricular septal defect;
— the presence/absence of ventricular outflow tract obstruction with the other diagnostic modalities.

For Pulmonary atresia:

— the presence/absence ofventricular septal defect;
— intracardiac anatomy;
— presence and size of the branch pulmonary arteries;
— source of pulmonary blood supply;
— side of the aortic arch.

For Hypoplastic left/right heart (fig. 3):

— mitral/tricuspid vulvar anomaly (congenital Parachute mitral valve, stenosis/ atresia);
— aortic valve or aortic root disease;
— stenosis/atresiapulmonary artery,right ventricular outflow obstruction;
— dimension of foramen ovale and ductusarteriosus.

CONCLUSIONS

1. Echocardiography reveals major congenital heart diseases with a high of accuracy (the number of diagnostic mistakes is 3,4%).

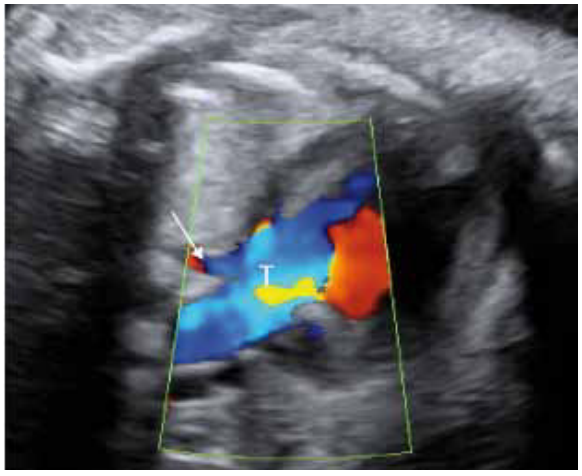

Fig. 1. *30 week of gestation Truncus Arteriosus (T) CDW. Source of Pulmonary atery (arrow)*

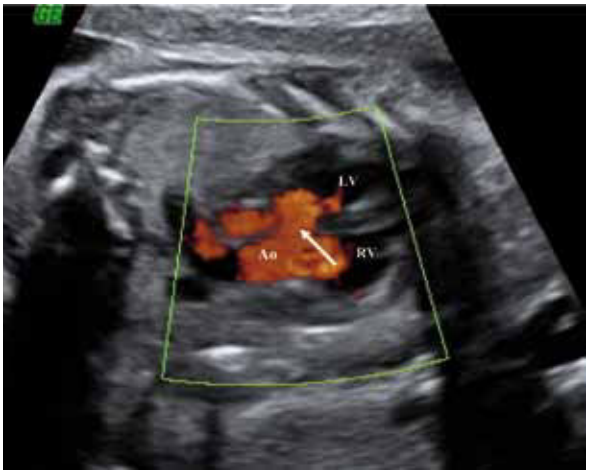

Fig. 2. *22 week of gestation. Tetralogy of Fallo. Power Doppler. Subaortic Ventricular septal defect (arrow)*

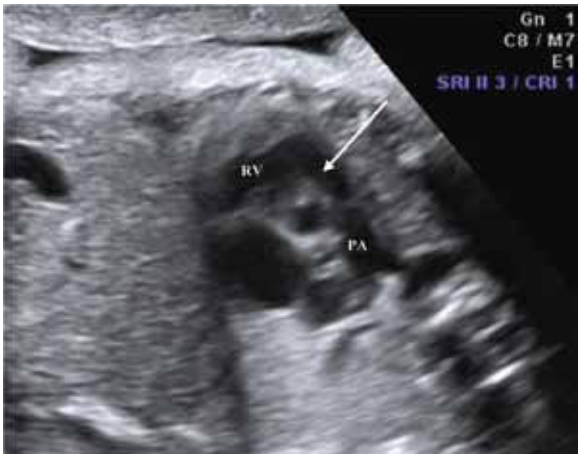

Fig. 3a. *22 week of gestation. TF. B-mode. Stenosis of pulmonary atery (arrow)*

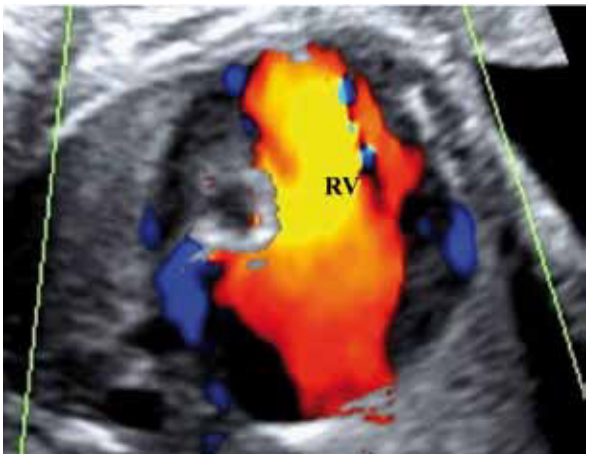

Fig. 4. *32 week of gestation. Color Doppler. Hypoplastic left heart*

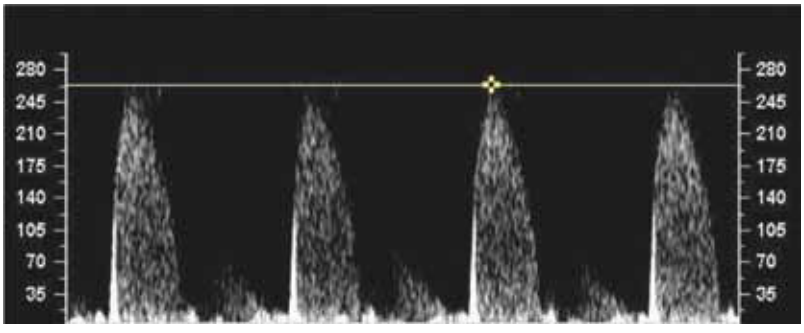

Fig. 3b. *22 week of gestation Pulse Doppler. Flow into PA*

2. Echocardiography will determine whether the fetus has the type of structural abnormality and detaliesspecifical CHD, that is very important for choice of *surgical repair* after birth.
3. Prenatal Echocardiography allows analyzed many factors influence the outcome of fetuses with CHD:research of morphological details for specific CHD, diagnosis of extracardiac malformations and chromosomal anomalies.

Table 1.

NAME OF CARDIAC ANOMALIES	N (abs)	(%)
Atrioventricular canal	163	6,8
Hypoplastic left heart	161	6,7
Tricuspid atresia	49	2,1
Conotruncal anamolies	409	17,1
Pulmonaty atresia+VSD/intact ventricular septum	43/17	1,8/0,7
Ventricular septum defects	914	38,2
Coarctation/interruption of the aorta	57	2,4
Anomalous pulmonary venous connection	12	0,5
Valvar anomalies	63	2,6
Single ventricle	65	2,7
Potential atrium septum defects	61	2,5
Cardiac tumors	25	1,1
Congenital coronary atery anomalies	5	0,2
Other complex heart defects	348	14,6
ALL	2392	100

Table 2.

OUTCOME	N (abs)	(%)
The termination of pregnancy	698	29,2
Intrauterine fetal death	4	0,2
Nejnetal death soon after birth	39	1,6
Fetal evalution (small VSD)	619	25,9
Surgical repair before 1 year	604	25,2
Surgical repair after 1 year	223	9,3
Are followed up by doctors, SR is planned in the future	205	8,6
ALL	2392	100

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