



## Pictorial review

# Coronary arteries in the fetal heart – a pictorial review

Maria Respondek-Liberska 



Department for Fetal Malformation's Diagnoses and Prevention, Medical University of Lodz, Poland  
Department for Fetal Cardiology, Medical University of Lodz, Poland  
Polish Mother's Memorial Hospital, Lodz, Poland

## Abstract

Coronary arteries (CA) in the fetal heart are seen very rarely. However, due to the introduction of the latest ultrasound technology, they can be seen in the late third trimester of pregnancy, regardless of the heart anatomy. Fetal haemodynamics can be analysed during fetal echocardiography not only in fetuses with fetal growth restriction, but also in normal fetal growth. Visualization of fetal coronary artery flow may have a temporary nature and therefore may suggest possible fetal heart compensation mechanisms. In the case of visualization of coronary artery by colour Doppler, pulse wave Doppler is recommended for the analysis of maximal velocity and direction of blood flow.

**Key words:** colour Doppler, spectral Doppler, functional anomaly.





## Corresponding author:

Prof. Maria Respondek-Liberska  
Polish Mother's Memorial Hospital  
Rzgowska 281/289  
93-345 Lodz, Poland  
e-mail: [maria.respondek-liberska@uni.lodz.pl](mailto:maria.respondek-liberska@uni.lodz.pl)

## Introduction

Coronary arteries (CA) in the fetal heart are seen very rarely. However, due to the introduction of the latest ultrasound technology, they can be seen in the late third trimester of pregnancy, regardless of the heart anatomy.

## Pictorial review

Based on our Unit Tricify4 cloud database of ultrasound images, 5 fetuses were selected for re-evaluation (2018 – Sept 2023, over 5000 exams). Their clinical data can be found in Table 1. All these fetuses were subject to examinations performed with the use of a GE 10 convex transducer with the Research Cardiology Preset for the second/third trimester of pregnancy. In all of the fetuses, CA were seen in colour Doppler (Figures 1 , 2 , 3 , 4, 5 , Table 2). In 2 of them, the presence of turbulent blood flow in coronary arteries was proven by spectral Doppler. Case 4 presented a bilateral blood

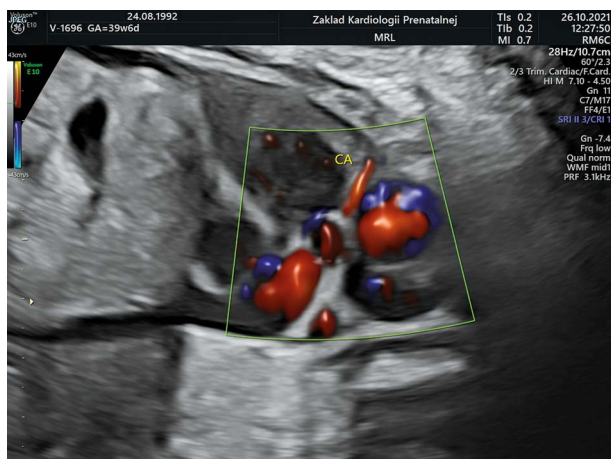
flow with a maximum velocity of up to 160 cm/sec in systole and 80 cm/sec in diastole (no survivor), whereas in case 5, a one-direction blood flow with a maximum velocity of 100 cm/sec (survivor) was observed.

All 5 fetuses presented different cardiac problems, including cardiomegaly + hypertrophy and tricuspid valve regurgitation due to absent ductus venosus, pulmonary critical stenosis, d-TGA, HLHS and AVC. All of them presented CA in the third trimester of pregnancy near term. A delivery by caesarean section took place in 4 cases out of 5. They were born alive with a birth weight of more than 3000 g and an Apgar score of 7 or more. Two out of 5 of them were asymptomatic, and HLHS was not considered for Norwood procedure due to neonatal lung oedema. However, 2 of them had cardiac procedures involving arterial switch operation on the 6<sup>th</sup> day of life, with a good result, and balloon valvuloplasty on the first day, with a good initial result; however, further digestive system complications

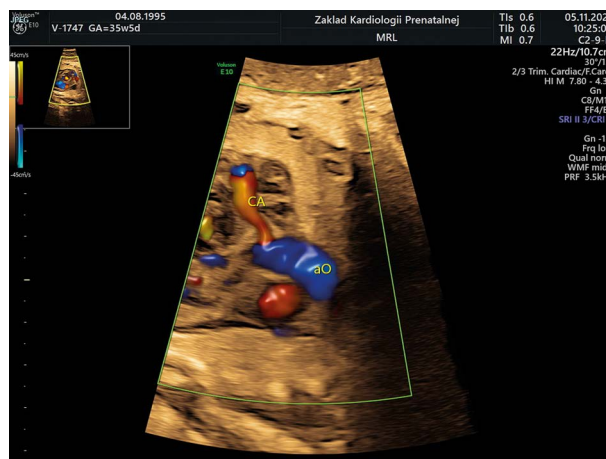
**Table 1.** Fetal echo, ultrasonography, neonatal follow-up

Case number	Maternal age	Gest age LMP	Biometry	Gender	US	Fetal echo	Possible explanation for temporary coronary arteries visualisation	Delivery	Neonatal birth weight (g)	Apgar score	Follow-up
1	28	39	39	Male	Absent DV Placentitis 7 cm AFI 6	Cardiomegaly, hypertrophy, TR, increased PV, 2VC	Increased combined cardiac output, but during fetal echo monitoring CA were visible only 1x	V	3020	9/9	24 days at the hospital no clinical signs
2	26	38	38	Male	Hydrops testis AFI 7	Pulmonary stenosis, TR, RVH	In differential diagnosis coronary artery ventricular fistulas however not existed during fetal life and postnatal life	CS	3350	9/9	Pulmonary valvuloplasty day 1 Dig tract complications, stomia
3	34	39	39	Male	Placentitis 8 cm	d-TGA	No restriction of the foramen ovale during fetal echo monitoring but an increased pulmonary venous blood flow	CS	3550	7/7	Rashkind day 1 ASO day 6 Home day 13 <sup>th</sup>
4	33	38	38	Female	Nutmeg lungs on fetal MRI	HLHS	Restriction of the foramen ovale was present, there were no coronary left ventricle fistulas	CS	3450	8/8	Conservative approach. Neonatal demise 4th day, no cardiac surgery
5	45	39	35	Female	Down S	AVC	There was no regurgitation	CS	3510	8/8/8 8/8	Asymptomatic

RE – tricuspid valve regurgitation, PV – pulmonary vein blood flow, 2VC – 2-vessel cord, RVH – right ventricular hypertrophy, d-TGA – transposition of the great arteries, HLHS – hypoplastic left heart syndrome, AVC – atrioventricular canal, US – ultrasonography



**Figure 1.** Coronary arteries in the fetal heart, colour Doppler. Case 1



**Figure 2.** Coronary arteries in the fetal heart, colour Doppler. Case 2



**Figure 3.** Coronary arteries in the fetal heart, colour Doppler. Case 3

and the use of stoma with prolonged hospital stay of up to 133 days were needed. In this short series of cases, in 3 out of 5 cases, the ultrasound visibility of coronary arteries had no clinical implications later on, but in one of them, with HLHS, which could be considered a poor sign for final outcome, and in another one, with critical PS, the possibility of long-term complications and blood flow impairment in the wall of his intestine cannot be ruled out.

### Discussion

There are very few papers on the issue of coronary arteries [1-7]. According to the Chaoui hypothesis, confirmed by the research carried out by Baschat and Gembruch [1-4], the visualization of coronary flow is an important part

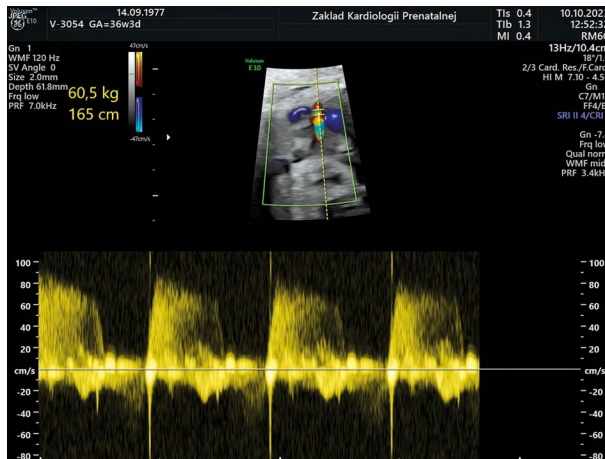


Figure 4. Coronary arteries in the fetal heart, colour Doppler. Case 4

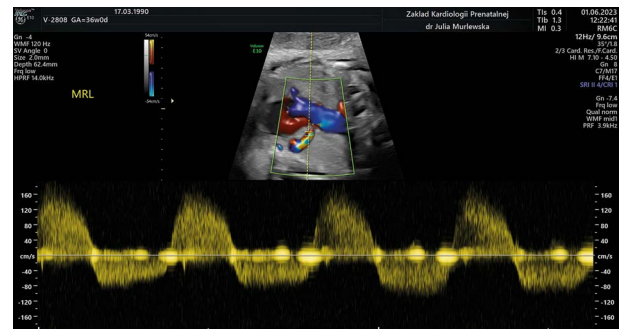


Figure 5. Coronary arteries in the fetal heart, colour Doppler. Case 5

Table 2. Coronary arteries (CA) – type of anatomy and prenatal echocardiography details

Case number	Fetal growth	Fetal Heart	Anatomy of CA	Fetal echocardiography
1	Normal fetal growth	Normal	Normal	Not visible in fetal echocardiography in 1 <sup>st</sup> or 2 <sup>nd</sup> term Maybe seen in 3 <sup>rd</sup> trimester in 2D and colour Doppler, maybe temporarily seen
2	Normal fetal growth	Heart defect Truncus arteriosus?	Intramural	Usually not detected by fetal echocardiography with the current technology
3	Normal fetal growth	Normal	Fistula – aberrant connection between coronary artery and heart chamber	Can be seen by colour Doppler in fetal cardiology centre During fetal heart monitoring could be seen cardiomegaly or congestive heart failure Early neonatal intervention usually is required
4	Normal fetal growth	Normal	Aorto-left ventricular tunnel – communication between the aorta and the left ventricle	Can be seen by colour Doppler in fetal cardiology centre during fetal heart monitoring Early neonatal intervention usually is required
5	Restricted fetal growth	Normal	Normal	Dilatation and “heart-sparing effect” The earlier gestational age and CA visible, usually more severe fetal or neonatal outcome

of the cascade of abnormal haemodynamic events that can be detected by Doppler in the fetus, especially in the case of intrauterine growth restriction. “Heart-sparing effect” is defined as the increased perfusion of the coronary arteries in fetuses with severe growth restriction and abnormal Doppler velocimetry in the peripheral vessels. Increased perfusion detected in colour and pulsed Doppler is a late sign of fetal compromise in hypoxaemia. However, none of the 5 presented fetuses presented intrauterine growth restriction.

Fetal coronary artery blood flow was also observed by Baschat during acute fetomaternal haemorrhage [5], but no such problem was observed in our cases. Baschat pointed out that visualization of the coronary artery was highly operator-dependent [6].

Our short series of cases enriches current knowledge with the conclusion that, in addition to fetal growth restriction or anaemia, enhanced coronary blood flow could also be a temporary event without clinical significance in the short-term prognosis, which is contrary to what has been reported so far [7].

In this series of cases, it is worth noticing a value not only of colour Doppler but also spectral Doppler with the measurement of the maximal velocity of blood flows.

## Conclusions

Fetal haemodynamics including coronary arteries, both in normal heart anatomy and in heart defects, could be analysed during fetal echocardiography not only in fetuses with fetal growth restriction, but also in normal fetal growth. Visualization of fetal coronary artery flow may have a temporary nature, and therefore may suggest possible fetal heart compensation mechanisms. In the case of visualization of coronary artery by colour Doppler, pulse wave Doppler is recommended for the analysis of maximal velocity and direction of blood flow.

## Conflict of interest

The author declares no conflict of interest.

## REFERENCES

1. Chaoui R. The fetal ‘heart-sparing effect’ detected by the assessment of coronary blood flow: a further ominous sign of fetal compromise. *Ultrasound Obstet Gynecol* 1996; 7: 5-9.
2. Baschat AA, Gembruch U, Harman CR. Coronary blood flow in fetuses with intrauterine growth restriction. *J Perinat Med* 1998; 26: 143-156.
3. Chaoui R. Coronary arteries in fetal life: physiology, malformations and the “heart-sparing effect?”. *Acta Paediatr Suppl* 2004; 93: 6-12.

4. Baschat AA, Gembruch U, Reiss I, Gortner L, Diedrich K. Demonstration of fetal coronary blood flow by Doppler ultrasound in relation to arterial and venous flow velocity waveforms and perinatal outcome – the ‘heart-sparing effect’. *Ultrasound Obstet Gynecol* 1997; 9: 162-172.
5. Baschat AA, Harman CR, Alger LS, Weiner CP. Fetal coronary and cerebral blood flow in acute fetomaternal hemorrhage. *Ultrasound Obstet Gynecol* 1998; 12: 128-131.
6. Baschat AA, Gembruch U. Evaluation of the fetal coronary circulation. *Ultrasound Obstet Gynecol* 2002; 20: 405-412.
7. Bui YK, Howley LW, Ambrose SE, Galan HL, Crombleholme TM, Drose J, et al. Prominent coronary artery flow with normal coronary artery anatomy is a rare but ominous harbinger of poor outcome in the fetus. *J Matern Fetal Neonatal Med* 2016; 29: 1536-1540.

**Division of work:**

Maria Respondek-Liberska (ORCID: 0000-0003-0238-2172): research concept and design, collection and/or assembly of data, data analysis and interpretation, writing the article, critical revision of the article, final approval of the article.