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Mini Review

How to Simplify the Complete Fetal Echocardiogram to Improve the Detection Rate of Congenital Heart Diseases: A New Approach in Anatomical Position

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Congenital heart disease (CHD) is the most common birth defect, with an incidence of 6 to 8 per 1000 in all live births [1]. Major CHD is a kind of cardiac abnormalities which will have a significant effect on the life of a child [2], and most of them require a surgical procedure in their early life [3]. Prenatal diagnosis of critical congenital heart disease improves newborn preoperative survival. Newborns with a postnatal diagnosis are more likely to die of cardiovascular compromise prior to planned cardiac surgery than are those with a prenatal diagnosis. The implications of an improvement in overall newborn survival following prenatal diagnosis could be far-reaching; they support expanded efforts to improve prenatal screening for congenital heart disease during routine obstetric examination, changes in sonographer training, updated recommendations for ultrasound examinations and improved access to fetal echocardiograms. Each of these involves significant time and resources and changes in practice for providers who care for women during pregnancy [4]. Diagnostic rates for CHD prior to delivery are suboptimal and influenced by socioeconomic factors. The effect is more notable when advanced views are required to make the diagnosis [4]. Complete fetal echocardiogram in a simple way can help to improve the detection rate of congenital heart diseases and increase the newborns and children survival.

The complete evaluation of the fetal heart is challenge due to the necessity to access all planes of the heart to reassure the normality or making diagnostics of congenital heart problems. After over than 3 thousand complete fetal echocardiograms performed, I have been created a pattern in anatomical position of the all planes of the fetal heart. This systematic approach can simplify the screening in one position of the fetal spine, between 1 and 2 o'clock, from 24 possibilities of the position of the baby: 12 fetal spine positions and their mirror images [5].

To perform the screening of fetal heart it is necessary 6 planes of the heart. Multiplying for 24 possibilities of the fetal spine, there will be 144 different planes of the normal heart. In abnormal hearts, this number increases to more than thousands different images.

Although some technologies have been created to access the fetal heart in an automatic approach, as spatiotemporal image correlation (STIC) and fetal intelligent navigation echocardiography (FINE) [6], these tools are 2D good images dependent.

Fetal heart anatomy is complex, and it is in movement. The valves open and close during the cardiac cycle and the baby is in movement as well. As medical students we all started study anatomy in anatomical position, and even before medical school we had in mind the anatomic patterns from our biology classes. So why not simplify the fetal echocardiogram?

In pediatric cardiology field there are fixed planes to perform echocardiogram. In my routine I bring the pediatric cardiology into

the fetal medicine world and with a Hight sensibility and specificity, I believe this new approach can help to improve the detection rate of congenital heart problems around the world.

After starting the exam looking for the position of the baby to determine the fetal lie and situs, the fourth-chamber view is putting in anatomic position. When the baby is in cephalic presentation and spine on the 1 to 2 o'clock position, the anatomic position come ready. However, in some positions, the heart is upside down. In this situation the machine has the tool to adjust the heart in anatomical position (Figure 1).

Figure 1: Four-chamber view.

From 4-chamber view to 5-chamber view, the aorta arises from left ventricle always from 5 o'clock to 11 o'clock position. Even with a not good window, the pattern can be inferred by color Doppler (Figure 2).

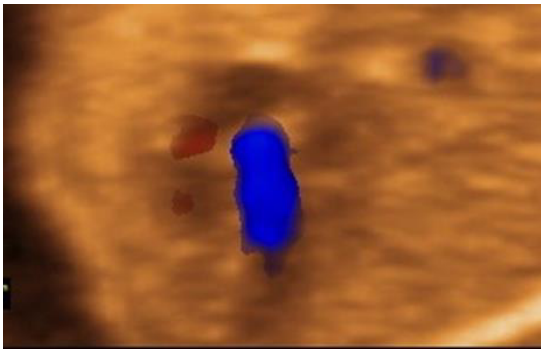

Figure 2: Five-chamber view.

Moving the transducer from 5-chamber view, the 3-vessel view will be always in the same position from down to up: MPA, aorta and SVC (Figure 3).

The screening has been done with these 3 planes most of congenital heart problems can be ruled out.

The second step is to put the four-chamber view in a transversal position. With the fetal spine in 4 o'clock position, the right chambers will be always up and left chambers down. This position, with the septum perpendicular to the probe, is the best way to check the integrity of the septum with low velocity color Doppler (Figure 4).

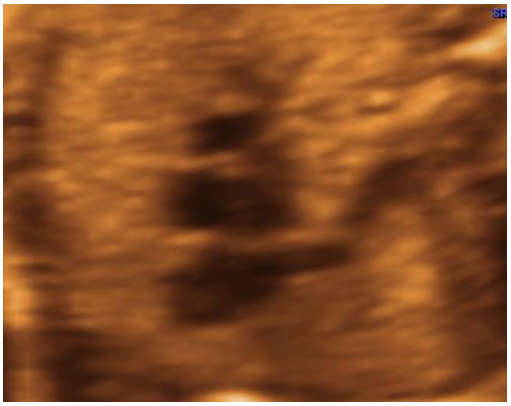

Figure 3: Three-vessel view.

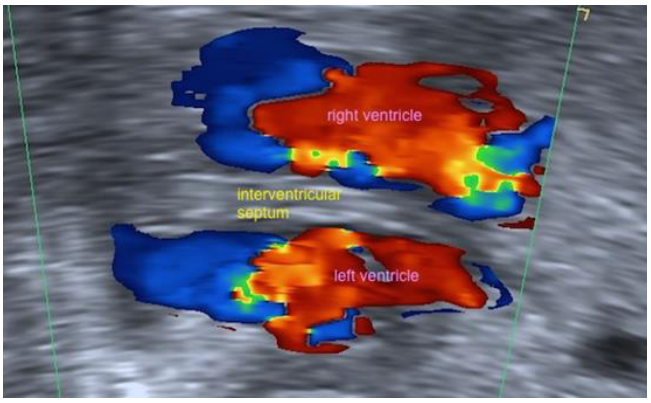

Figure 4: Interventricular septum.

From 4-chamber view to long axis view, the left ventricular outflow tract is from 8 to 2 o'clock direction. This plane reassures the 5-chamber view. And arriving at the most complex plane of the heart, where aorta crosses the pulmonary artery from posteriorly to anteriorly, the V sign appears (Figure 5).

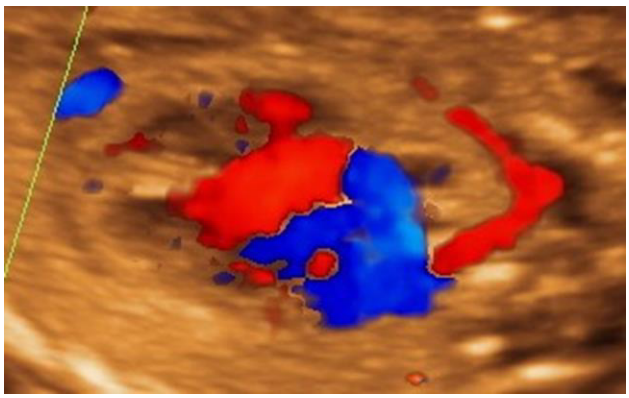

Figure 5: Long axis view with aorta and ARSA.

In V sign plane, to facilitate the diagnostic of right aortic arch, the right in on the right side and the left in on the left side of the screen (Figure 6).

Moving the transducer 90 degrees, from V-sign, the ductal and aortic arch are in longitudinal position (Figure 7).

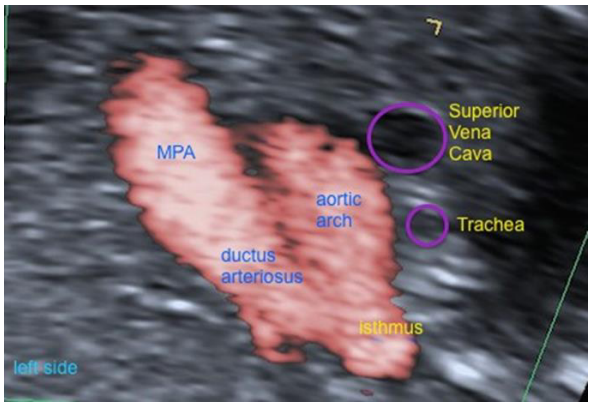

Figure 6: V sign (three- vessel-traquea view).

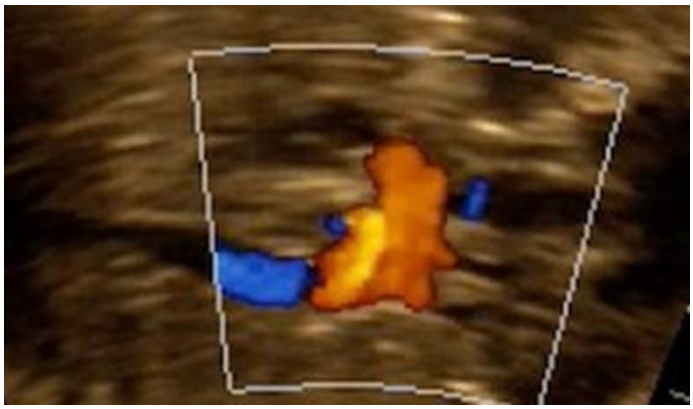

Figure 7: Aortic and ductal arch.

And, finally, although they are not at the same plane, sometimes it is possible to get the inferior vena cava and descending aorta in 2D image, at the same picture, to rule out interrupted inferior vena cava and azygos continuation (Figure 8).

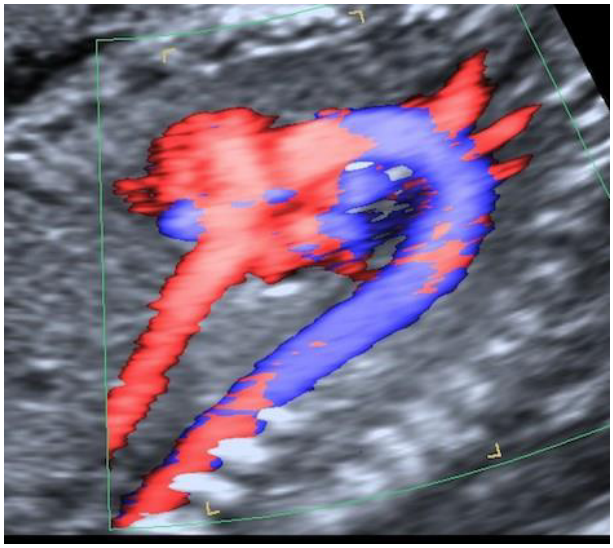

Figure 8: Aortic arch and inferior vena cava.

In conclusion, this new approach has not the intention to supersede the official guidelines for the performance of the fetal echocardiography examination, but to add an option in helping to improve the detection rate of congenital heart diseases and increase the newborns and children survival.

Acknowledgement

None.

Conflict of Interest

Author declares no conflict of interest.

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