

Fetal Cardiology – the role of the fetal cardiac sonographer

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My role as a fetal cardiac sonographer is the most rewarding job I have had. I started my career as a radiographer in a large teaching hospital, later specialising in computed tomography (CT) and adult cardiac cath lab where I worked for more than 10 years. Whilst on maternity leave an advert for a physiologist to learn to scan fetal hearts caught my eye. This was a training post in the fetal cardiology department at Evelina London Children's Hospital. I was lucky enough to be appointed and began my training in fetal cardiology. This was completely new to me, never having trained in ultrasound or echocardiography. It was a steep learning curve as I was also having to learn about congenital heart disease and the fetal circulation. Unlike the adults in the cath lab, I would now be chasing a moving target!

Congenital heart disease (CHD) is the most common group of congenital malformations with an incidence of 8 per 1000 live births and around half of these babies will require surgery or catheter intervention in infancy.¹ Identifying before birth which babies will need early treatment is important to improve their outcomes, quality of life and for preparing expectant parents for their journey ahead.^{2,3} In the UK, all pregnant women are offered two pregnancy scans, one at 11-14 weeks where the fetal heart structure is not usually assessed and a second between 18 and 20 weeks + 6 days where the fetal heart is assessed by an obstetric sonographer. Five views of the fetal heart are assessed using 2D ultrasound, according to the National Fetal Anomaly Screening Programme (FASP) guidelines.⁴ If these views are not normal, then referral to a fetal cardiology unit is made and this is where most of my work originates from.

Fetal Cardiology is an established specialty in the UK, with all paediatric cardiac centres having a fetal cardiology unit. At Evelina London Children's hospital we perform around 2,500 scans each year, around 500 of which have a diagnosis of CHD. Approximately 160 of these babies are delivered at St Thomas' Hospital each year in order to expedite peri and post natal care.

In the UK we have a good prenatal detection rate compared to some other developed countries, the UK average being around 55%, but in the South East of England this is much higher.⁵

Having an antenatal diagnosis rather than postnatal gives parents the opportunity to receive counselling and to acquire information about the treatment options and likely outcomes of

the pregnancy or the baby's future. It also allows for the fetus to undergo further imaging for extra cardiac anomalies, and for genetic testing or counselling. Planning of the mode and location of delivery of the baby can be made, as well as having a plan for postnatal care.

In our CHD clinics, we see expectant patients who have just had the devastating news that there might be a problem with their baby's heart. This requires a sensitive, caring and supportive approach to our patients and their partners. Helping parents remain calm enables us to complete the scan effectively.

The scans are undertaken according to a special protocol of assessing all the cardiac connections which is similar to, but not the same as, a paediatric echo. We use colour flow Doppler and perform measurements of structures to assess them in detail. As the size of the fetal heart varies through gestation – from the size of a grain of rice at 12 weeks to an olive at 20 weeks – we need to assess the size of structures according to the age of the baby. We record precise still images and 'cine' loops throughout each scan. We report measurements and Z scores of the outflow tracts and pulsed wave Dopplers of the inflow and outflow tracts.^{6,7}

The scans are reviewed with our fetal cardiology consultant who will discuss with the parents the findings, requirement for postnatal surgery, short, medium and long term outcomes and likely quality of life. The consultants also discuss whether the heart defect might be associated with other problems (for example genetic or chromosomal conditions) together with options of pregnancy management. We have fetal cardiology

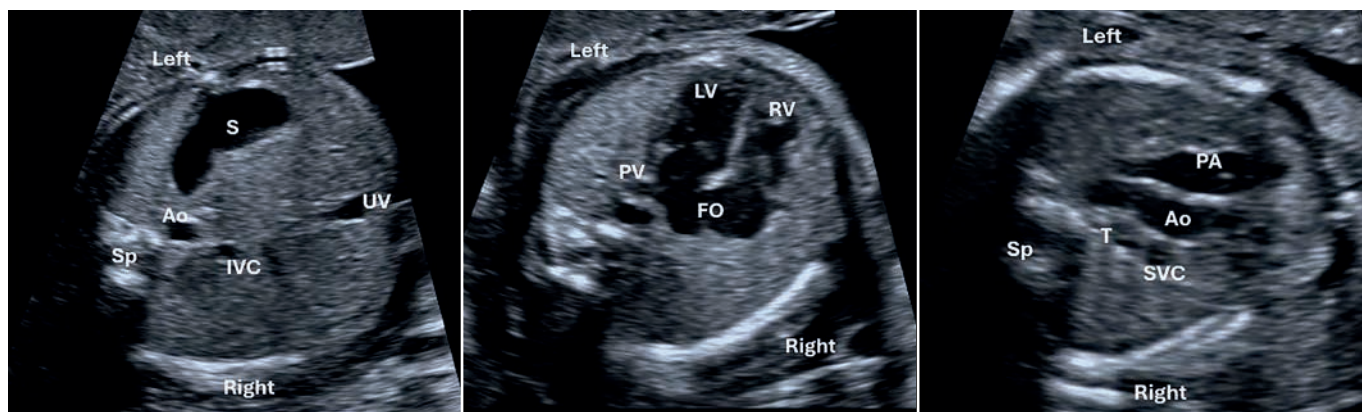


Fig 1, 2, and 3. Normal situs, normal 4 chamber, normal 3 vessel view (Abbreviations: S-stomach; Sp-spine; Ao-Aorta; IVC-Inferior Vena Cava; UV-Umbilical Vein; PV-Pulmonary vein; FO-Foramen Ovale; LV-Left Ventricle; RV-Right Ventricle; PA-Pulmonary Artery; SVC-Superior Vena Cava; T-Trachea).

clinical nurse specialists who are involved in these discussions and support the families throughout.

The other part of my role is undertaking advanced screening of the fetal heart for pregnancies with an increased chance of being affected by CHD. This includes first degree relatives of the fetus having CHD, or maternal reasons such as diabetes, medications, auto immune disorders. In these clinics, the sonographers have autonomy over the performing and reporting of scans. There is always back up should the need arise, for example in the case of detecting abnormality or intra uterine death.

As ultrasound technology advances a few patients are referred with query CHD as early as 12-14 weeks' gestation due to suspicious heart views at the dating or nuchal scan. It is challenging to achieve good image resolution and therefore the scanning technique needs to be adjusted, as well as parental expectation being set. All our scans are performed trans abdominally. The sonographer adjusts machine settings from the fetal cardiac presets to achieve high frame rates and good contrast by decreasing the dynamic range and depth. We use a narrow sector width and magnify the image to optimise image quality where possible. The focus is adjusted as the fetus moves around. This improves lateral resolution, making it easier to see the smaller details. The ALARA principle is observed, the mechanical and thermal index kept as low as possible.

Learning and research are integral to our department, and the fetal cardiac sonographers are involved in various ways. Some examples of current research studies include iFIND (Intelligent fetal imaging and diagnosis), FIMOX (Fetal imaging with maternal oxygen), PLACARD (Placental cardiac imaging study), BEATS (Fetal ECG). Sonographers can help recruit, inform or scan patients. We assist in accurate data collection. There are ongoing AI studies in which the experienced fetal cardiac sonographers analyse and label images. Some of our patients have fetal cardiac MRI which is offered at a few units nationwide, including Evelina London Children's hospital. This can be used for example in helping to predict which fetuses will have severe neonatal coarctation of the aorta, needing early postnatal intervention.⁸

Practical one to one teaching of specialist registrars, research fellows, visitors and peers is a large part of the everyday role of the fetal cardiac sonographer. Although there is currently no formal accreditation in the UK, we work to the British Congenital Cardiac Association standards. There are random quality checks on our scans and reports. We actively chase up outcomes of pregnancy to assess and learn from false positive or false negative reporting.

Multiple pregnancies bring challenges to the scanning technique with twins or triplets' limbs and bodies often overlying each other. Although rare, even fetuses have heart rhythm problems. We can assess the heart rate and rhythm using Doppler measurements and M mode, which is fun on a moving object. However we cannot reliably ascertain a fetal ECG yet! We use SMI or superb micro vascular imaging for early scans where delineating tiny structures is difficult.

We are a close multi-disciplinary team, constantly communicating with other teams at Evelina London, St Thomas' as well as other hospitals. Our fetal cardiac sonographer team are from backgrounds such as paediatric cardiac physiology, paediatric nursing and radiology. This diverse range of professional experience brings a unique strength to our team.

If anyone is looking for a challenging, rewarding, autonomous yet supported career I would wholeheartedly recommend this one!

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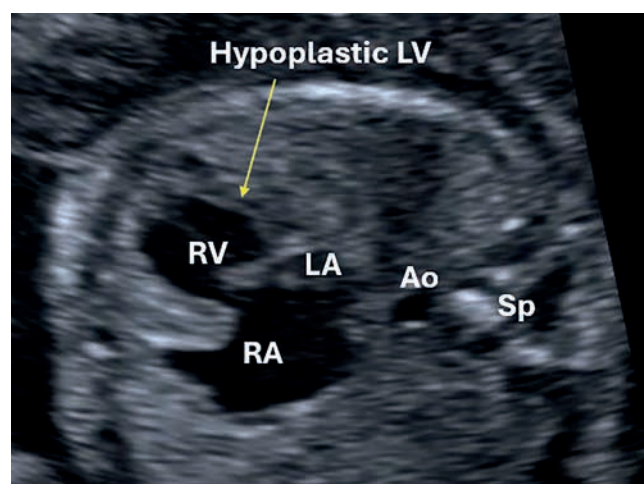


Fig 4: . Hypoplastic Left Heart. RV-Right Ventricle; RA-Right Atrium; LA-Left Atrium; Ao-Aorta; Sp-Spine.

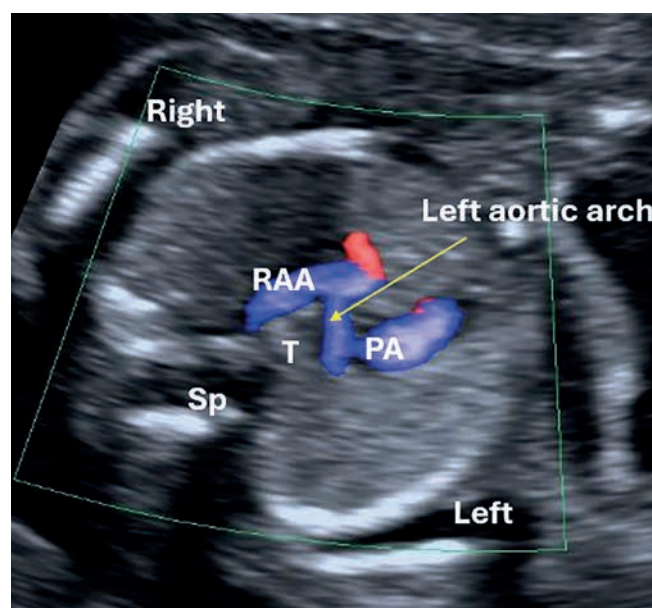


Fig 5: Double Aortic Arch (Abbreviations: RV-Right Ventricle; LA-Left Atrium; RA-Right Atrium; Ao-Aorta; Sp-Spine; RAA-Right Aortic Arch; T-Trachea; PA-Pulmonary Artery; Sp-Spine).

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