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REVIEW ARTICLE

Recognition of Normal Fetal Cardiac Structures

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Abstract Fetal heart examination requires in depth knowledge of fetal cardiac physiology and fetal cardiac anatomy. Therefore, the cardiac sonographer must possess considerable skills to acquire optimum images on cardiac anatomy on predefined standard views. An appropriate interpretation of acquired fetal cardiac images is also a basic requirement that is expected from a cardiac sonographer. Any cardiac ultrasound operator who performs the fetal heart scan is expected to recognize normal cardiac structures, to assess myocardial function and heart rhythm but also should be able to pick up any deviation from well-defined normality.

Keywords Fetus · Heart · Anomaly · Three-vessel trachea · Four chamber · Cardiac outflow tract

Introduction

Fetal heart examination is a comprehensive process which comprises first trimester aneuploidy scan (11–14 weeks of gestation), anomaly scan (20–24 weeks) and well-being scan (30–34 weeks). Although cardiac anomaly screening constitutes only one aspect of the 20-week anomaly scan, it poses more challenges to an ultrasonographer owing to its complex architecture and dynamic movements. Even though transvaginal ultrasound scan can reveal some abnormalities at 12–13 weeks, the detection of cardiac anomalies is mainly the target of midtrimester transthoracic ultrasound examination. The 20-week routine fetal cardiac anomaly screening, that can be performed by a variety of operators such as an ultrasonographer, a specialist midwife sonographer, a radiologist, or a fetal medicine specialist, is different from performing detailed fetal echocardiography. On the other hand, detailed fetal echocardiography is commonly performed by the fetal cardiologist on either high-risk patients or after the detection of an anomaly at the 20-week anomaly scan.

The recommended indications for fetal echocardiography include maternal, fetal, and familial conditions (Table 1). Detailed fetal echocardiography is commonly indicated in high-risk patients with well-recognized risk factors for increased likelihood of cardiac abnormality. Nonetheless, it should be remembered that an important percentage of prenatally detected congenital heart diseases would occur in low-risk patients. Our own practice review over the past 15 years also supported this notion that majority of cardiac abnormalities were identified by screening sonographers in so-called low-risk population at the 20-week anomaly scan (Table 2). This fact strengthens the argument that increasing sonographers' knowledge and skills at district general hospitals may result in a higher detection rate of congenital heart anomalies with reduced number of unnecessary referrals because of perceived high risk in otherwise normal population. Indeed such strategy in Wales resulted in the highest detection rate of congenital heart defect (CHD) in the UK with concurrently reduced number of false positive rates.

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Table 1 Indications of fetal echocardiography

I. Maternal indications

1. Systemic collagen disease, in the presence of anti-Ro, anti-La antibodies
2. Maternal metabolic disorders
3. Maternal use of nonsteroidal anti-inflammatory drugs after 25 weeks
4. Maternal exposure to teratogenic drugs during pregnancy
5. Maternal congenital heart disease and familial cardiomyopathy

II. Fetal indications

1. Abnormal finding during routine cardiac ultrasound
2. Increased nuchal translucency
3. Fetal hydrops, hydrothorax, and polyhydramnios
4. Presence of extracardiac anomalies
5. Chromosome abnormalities
6. Arrhythmias
7. Fetal conditions associated with fetal heart failure

III. Familial indications

1. Father or sibling with congenital heart disease or heart block
2. Mother or father has Marfan syndrome, or any other genetic syndrome which has Mendelian transition and may affect the heart

Table 2 Abnormal echocardiography rate according to fetal referral criteria

Referral reason	Normal	Abnormality confirmed (%)
Previous child with CHD	216	12 (5)
Maternal CHD	94	5 (5)
Family history of CHD	351	6 (2)
IDDM	56	1 (2)
Increased nuchal thickness	84	7 (8)
Maternal medical condition	57	6 (10)
Associated congenital anomalies	153	47 (24)
Fetal arrhythmia	182	11 (6)
Poor image	11	3 (21)
Suspected anomaly at the 20-week routine scan	398	392 (50)

CHD congenital heart defect, *IDDM* insulin-dependent diabetes mellitus

Cardiac Examination

Optimal views of the heart can be readily obtained when the fetal abdomen and hence the cardiac apex is directed toward the anterior maternal wall. Physical obstacles such as anterior placenta and maternal obesity or unfavorable fetal position may make cardiac examination more difficult and sometimes, impossible. When fetal position is not good enough for scanning then one may choose to postpone the examination to a different time or to ask the patient to walk about for a few minutes and to come back for a repeat scan.

A stepwise assessment of the fetal heart includes acquisition of the standard views and a correct interpretation of all cardiac structures in each of the below listed planes (Table 3) [1]:

- Cardiac situs, axis, and size.
- Heart rate and rhythm.
- Four-chamber view.
- Outflow tracts—left and right ventricular outflow tracts.
- Three vessel and trachea views.
- Sagittal ductal and aortic arch views.
- Sagittal bicaval view.

Situs, Axis, and Size

The first step in fetal cardiac examination is to define fetal presentation and lie. The orientation of the fetus within the uterus with reference to maternal left–right should be clearly determined. The heart and the stomach both should be on the same side of the spine, that is, the left side of the fetus (Fig. 1). The descending aorta should be on the left side of the spine too. The inferior vena cava should be seen more anteriorly to the aorta and on the right side of the spine. When the fetal heart and stomach are not on the left side, a situs abnormality is present. If the descending aorta and the inferior cava rings are on the same side of the spine, then the atrial situs is again likely to be abnormal.

The normal cardiac situs (situs solitus) is defined by the position of the morphological left atrium that should be facing to the left side of the fetal chest. An abnormal situs (situs inversus) is defined if the fetal left atrium is positioned on the right side of the fetal heart regardless of whether this is dextrocardia or levocardia. If there is atrial isomerism (where there are two right or left atria) then a situs ambiguous is present. Orientation of the heart or apex only describes whether the majority of the fetal heart mass is positioned on the right side (dextrocardia), in the middle (mesocardia), or on the left side (levocardia) of the fetal chest. Since an abnormal abdominal situs can accompany thoracic positional anomalies, the presence and location of the stomach, the liver, the spleen, the IVC, the DAO, the ductus venosus, and the hepatic vessels should also be defined carefully. These positional abnormalities can also exist as an isolated finding without any associated problems or congenital heart disease.

The cardiac axis is calculated from a line drawn posteriorly from the fetal spine anteriorly to the fetal sternum (Fig. 2). The ventricular septum should intersect this virtual line at 40°–45°, so, the apex should be directed approximately 40°–45° to the left, though ±20°

Table 3 Anatomical features of normal cardiac structures and their ultrasound scanning planes

Structure	Defining features	Best scanning view
Right atrium	1. Receives inferior vena cava and superior vena cava	1. Sagittal
	2. Broad based appendage	2. Sagittal
	3. Receives coronary sinus	3. Four chamber
	4. Connects to tricuspid valve	4. Four chamber
Left atrium	1. Receives pulmonary veins	1. Four chamber
	2. Finger like long-narrow based appendage	2. Parasternal short axis
	3. Flap valve of foramen ovale floats inside	3. Four chamber
	4. Connects to mitral valve	4. Four chamber
Right ventricle	1. Always receives tricuspid valve	1. Four chamber
	2. Tricuspid valve attaches to interventricular septum	2. Four chamber
	3. Tricuspid valve more apically positioned	3. Four chamber
	4. Moderator band at apex	4. Four chamber
	5. Coarse trabeculation	5. Four chamber
	6. Connects to a bifurcating pulmonary artery	6. Parasternal short axis
Left ventricle	1. Receives mitral valve	1. Four chamber
	2. Mitral valve more basally positioned	2. Four chamber
	3. Mitral valve attaches to free wall only	3. Parasternal long axis
	4. Apex wide open, no moderator band	4. Four chamber
	5. Fine trabeculations at apex	5. Four chamber
	6. Connects to a non-bifurcating aorta with head and neck vessels arising from its above surface	6. Parasternal long axis
Pulmonary artery	1. Arises from anterior right ventricle	1. Parasternal short axis
	2. Trifurcates into right, left pulmonary artery and ductus from its distal end within first centimetre of its origin	2. Parasternal short axis
	3. Continues with ductus arteriosus into descending aorta	3. Sagittal ductal arch
	4. First vessel on transverse tomographic view	4. Three vessel trachea
Aorta	1. Arises from posterior left ventricle	1. Parasternal long axis
	2. Gives off three branches (head and neck arteries) from its above surface superiorly towards neck	2. Sagittal aortic arch view
	3. Shows fibrous continuity with mitral valve	3. Parasternal long axis
	4. Second vessel on transverse tomographic view	4. Three vessel trachea
Ductal arch	1. Arises anteriorly with horizontal golf club appearance	1. Sagittal ductal arch
	2. Trifurcates with left and right pulmonary arteries and ductus arteriosus	2. Sagittal ductal arch
	3. In continuity with ductus arteriosus and descending aorta	3. Sagittal ductal arch
		4. Three vessel trachea
Aortic arch	1. Round-walking stick appearance	1. Sagittal aortic arch
	2. Gives off head and neck vessels superiorly	2. Sagittal aortic arch
	3. Arises from the middle of chest	3. Sagittal aortic arch
	4. Arches to the left of trachea	4. Three vessel trachea
Tricuspid valve	1. Always attaches to right ventricle	1. Four chamber
	2. Lower attachment than mitral valve at base	2. Four chamber
	3. Attaches to three papillary muscle	3. Parasternal short axis
	4. Has three leaflets	4. Parasternal short axis
Mitral valve	1. Always attaches to left ventricle	1. Four chamber
	2. Attaches to two papillary muscle	2. Parasternal short axis
	3. Has higher level attachment than tricuspid valve onto interventricular septum	3. Four chamber
	4. Has fibrous continuity to aortic valve	4. Parasternal long axis
	5. Has two leaflets	5. Parasternal short axis

Table 3 continued

Structure	Defining features	Best scanning view
Superior vena cava	1. Third and smaller vessel on transverse tomographic view	1. Three vessel view
	2. Adjacent to aorta	2. Sagittal view
	3. Connects to right atrium from above	3. Sagittal view
Inferior vena cava	1. Receives hepatic veins and ductus venosus	1. Sagittal view
	2. Connects to right atrium from below	2. Sagittal view
Pulmonary veins	1. Two vessels from right and two vessels from left lungs drain into left atrium, respectively	1. Four chamber view
Ductus venosus	1. Connects umbilical vein to inferior vena cava	1. Sagittal view
	2. It connects to inferior vena cava at left hepatic vein junction	2. Sagittal view

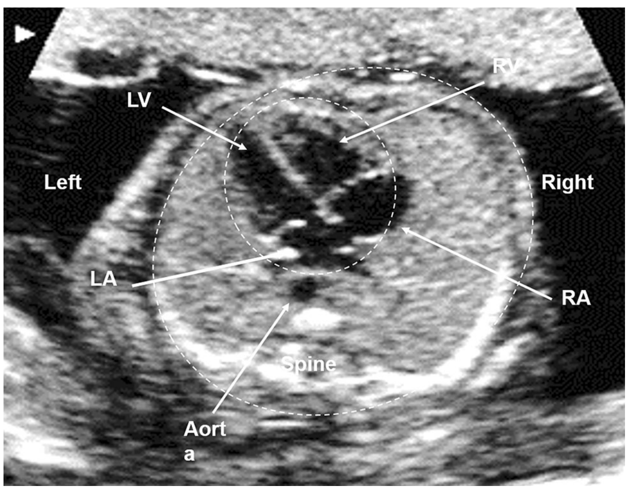

Fig. 1 Normal fetal cardiac situs. This view is helpful in demonstrating cardiac and thoracic sizes and ratios

are acceptable (2 standard deviation). Cardiac (particularly outflow tract anomalies) and noncardiac abnormalities (congenital diaphragmatic hernia) can change the angle of the normal cardiac axis.

The heart occupies approximately one-third of the cross-sectional area of the thorax. The circumference may also help to define the size of the heart. Cardiac circumference is approximately half of the circumference of the fetal thorax. The area or the circumference of the fetal heart is not routinely calculated but when clinically indicated the screening sonographer must be able to perform such measurements.

The umbilical cord should have three vessels; two-vessel cord may be associated with renal and cardiac abnormalities including hypoplastic left heart syndrome, coarctation of the aorta, tetralogy of Fallot, hypoplastic right heart due to pulmonary atresia, absent ductus venosus, and transposition of the great arteries [2]. The umbilical vein should approach the liver from the midline to the right plane and should branch out to connect to the IVC via the ductus venosus and to the portal vein via the right branch. There should be no ascites or pleural effusion; but a rim of localized pericardial effusion of less than 2 mm in systole may be considered normal [3]. Abnormal findings in any of these evaluations should prompt a more detailed examination of the fetal heart structures and the whole fetus.

Heart Rate and Rhythm

In order to evaluate the heart and rhythm, an operator should acquire cardiac wall motion or flow velocity tracings via employing pulse wave Doppler, tissue Doppler, or M-mode ultrasound modalities (Fig. 3) [4]. The normal heart rate at midgestation ranges from 110 to 160 beats per minute (bpm), with no pauses, no skipped or extra beats. The mitral and tricuspid valves should open and close almost simultaneously. If there is any suspicion of bradycardia, tachycardia, or irregular rhythm, the atrial and ventricular contractions should be acquired simultaneously to determine the nature of arrhythmia by analyzing atrioventricular relationships and individual rates of the atrial and ventricular contractions. Mild or transient bradycardia may be observed in a normal second-trimester fetus but any sustained bradycardia needs careful evaluation of feto-placental unit by a fetal cardiologist and fetal medicine specialist to exclude fetal heart block, maternal and fetal LQT syndrome, atrial isomerism, myocarditis, and non-cardiac causes such as fetal infections, placental insufficiency, and fetal distress. Differentiation of fetal heart block from blocked atrial premature beats may be quite challenging. The same principle holds true for mild fetal tachycardia too (heart rate >160 but <180 bpm). Mild transient sinus tachycardia can occur in a healthy fetus during active movements but any sustained tachycardia deserves more stringent evaluation.

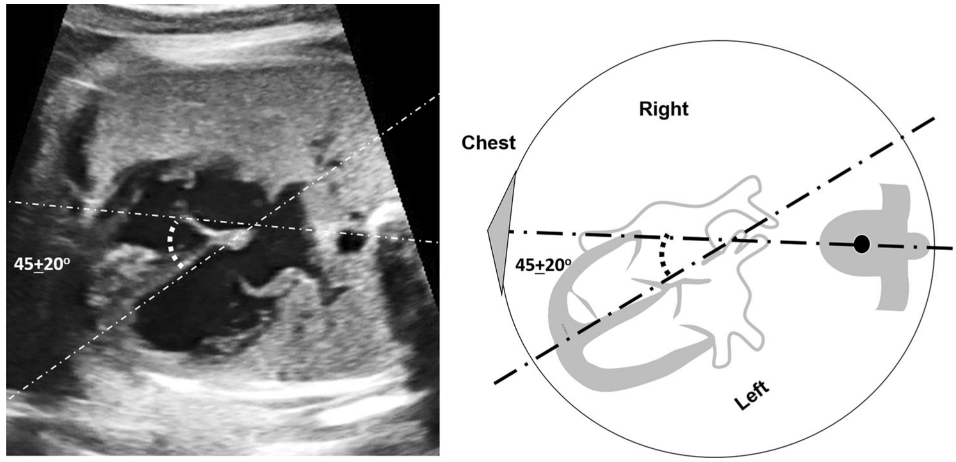

Fig. 2 The figure illustrates how to measure the normal cardiac axis. The *acceptable angle* between the anteroposterior axis of the thorax and the atrioventricular septum is 45° + 20°

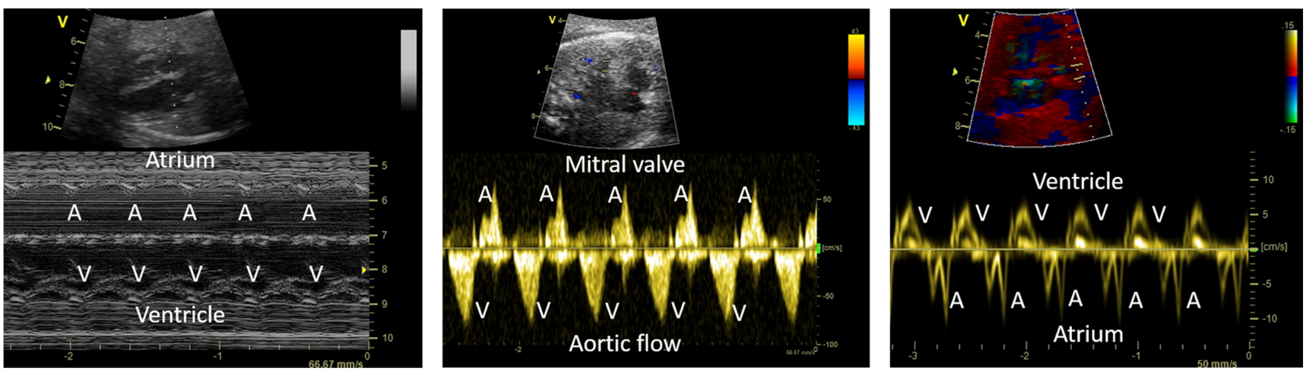

Fig. 3 Assessment of fetal heart rhythm. **a** Simultaneous recording of atrial and ventricular M-mode Doppler, **b** simultaneous recording of mitral and aortic pulse wave Doppler, **c** simultaneous recording of atrial and ventricular deformation from tissue Doppler

Evaluation of Normal Cardiac Structures

Most routine cardiac ultrasound screening in midgestation includes the four-chamber and the outflow tract views. However, examination of the fetal heart cannot be considered complete unless all cardiac structures, Doppler flows across the valves, along with cardiac rhythm and function are assessed from all seven planes (Fig. 4). The importance of using color flow and fetal biometry in the aid of diagnosing major cardiac anomalies cannot be emphasized enough. Most national screening programs in the UK include four scanning planes (situs, four-chamber, left ventricular outflow, and right ventricular outflow views), but these protocols are now being further strengthened with an additional three vessel and trachea view. The main objective of this document is to outline acquisition of standard fetal cardiac screening planes and to define the characteristic features of normal cardiac structures in each of these planes (Table 3).

Four-Chamber View

The four-chamber view is an important part of the fetal heart examination. Some basic cardiac screening programs rely mainly on this view (Fig. 5). The four-chamber view is obtained by a transverse projection through the fetal thorax above the level of the diaphragm. This view may be longitudinal or perpendicular to the interventricular septum, and the latter provides more reliable information for the evaluation of ventricular septal defects.

There are several points that should be carefully confirmed on four-chamber view; a systematic approach is crucial not to miss any of these checkpoints [1]:

- Cardiac situs, axis, and size should be within normal limits as described above.
- No pericardial effusion should be seen.
- Two atria and two ventricles on the right and the left sides should be equal in size.
- The foramen ovale flap should open into the left atrium.

- The pulmonary veins should enter the left atrium but this evaluation is not a part of a routine cardiac anomaly scan.
- The primum atrial septum (lower rim of atrial septum) should be present.

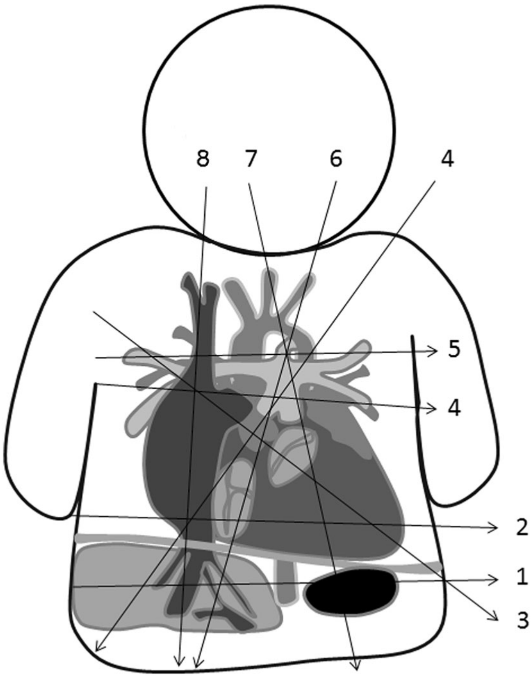

Fig. 4 Eight standard cardiac scanning views— (1) cardiac situs, (2) four-chamber, (3) parasternal long axis showing *left* ventricular outflow, (4) parasternal short axis showing *right* ventricular outflow, (5) three vessel and trachea view, (6) sagittal ductal arch, (7) sagittal aortic arch, and (8) sagittal bicaval view

- The moderator band should be seen in the morphological right ventricle and the same ventricle that has the moderator band should be the ventricle situated on the right side.
- The left ventricle should be positioned posteriorly and on the left side of the heart. The left ventricle has fine trabeculations compared to coarsely trabeculated and slightly dominant right ventricle. The size of the right ventricle being up to 10 % bigger than the left ventricle can be considered to be a normal finding.
- A normal heart has biventricular connection that each atrium connects to a corresponding ventricle (atrioventricular concordance). The right atrium (the atrium that has a broad based appendage and receives the vena cava superior and vena cava inferior) connects to the morphological right ventricle (the ventricle that has the moderator band). The left atrium (the one that has a narrow-based (finger-like-long) appendage and receives pulmonary veins) should connect to the morphological left ventricle. This latter evaluation, however, may not be a part of routine anomaly scan but can help determine the atrial situs most accurately in the fetus.
- Ventricular septum should be intact. It should be examined from the apex to the crux of the heart. Color flow and pulse wave Doppler ultrasound modalities may offer further help to detect even smaller defects in the ventricular septum. Better detection of ventricular septal defect from the four-chamber view can be achieved if the insonation of ultrasound beam can be aligned perpendicular to the ventricular wall.
- Both atrioventricular valves should be equal in size and move freely. Minimal tricuspid valve regurgitation can be seen in normal fetuses.

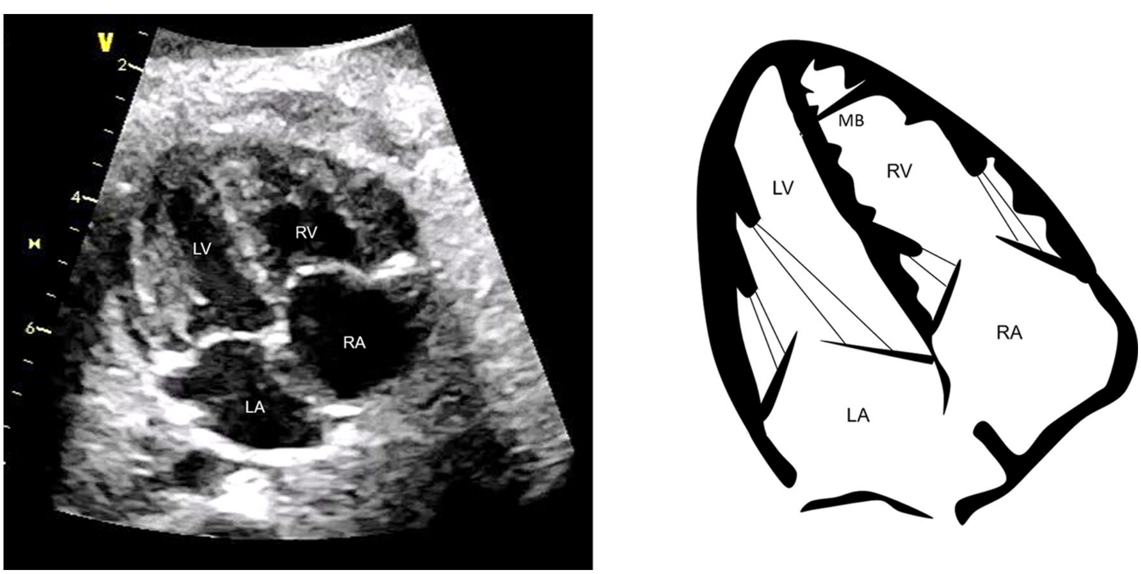

Fig. 5 The four-chamber view. This view shows four chambers, inlet valves, and atrial and ventricular septum

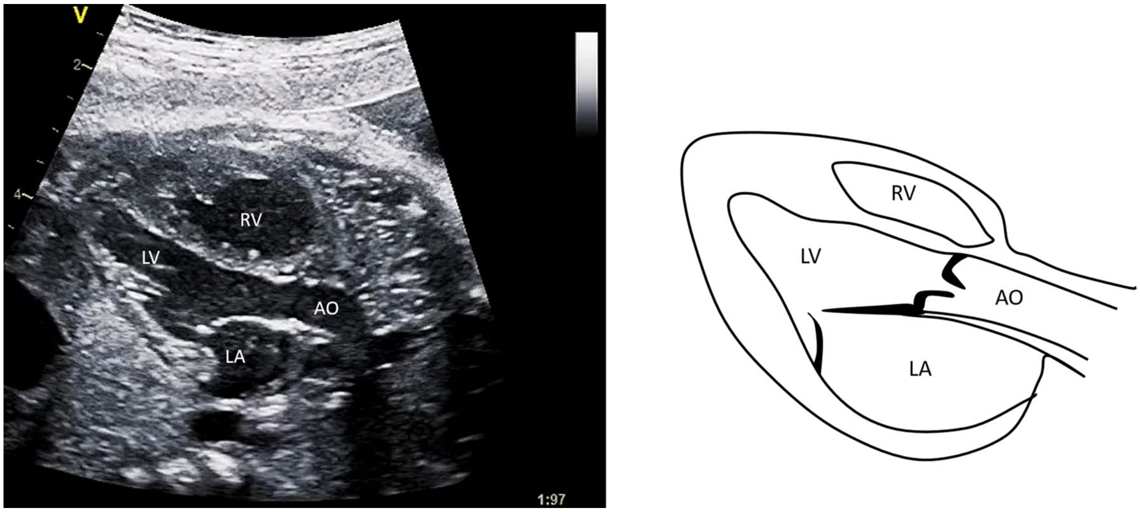

Fig. 6 *The left* ventricular outflow tract view. This view shows the left atrium, mitral valve insertion points to the free wall of the left ventricle, left ventricular apex, ventricular septum, right ventricular cavity, left ventricular outflow, mitral and aortic valve continuity, aortic valve leaflets and the aortic root

- The septal leaflet of the tricuspid valve should be inserted to the septum closer to the apex, more apically, when compared to the mitral valve which inserts into the ventricle more superiorly. The tricuspid valve has septal attachments but the mitral valve has attachments to the left ventricular free wall only.

Outflow Tracts

Routine views of the left and the right ventricular outflow tracts are now being considered a part of routine mid-trimester cardiac screening. The evaluation of the outflow tracts substantially improves the detection rates of serious cardiac malformations [1, 4–7]. One should visualize the size, origin, position, and opening of the aorta and the pulmonary artery. Although, the outflow tracts can be demonstrated from various planes there are two standard (the parasternal long axis-left outflow, the parasternal short axis-right outflow), and two common complementary views (the sagittal ductal-aortic arch and the three vessel-trachea views).

1. *The Left Ventricular Outflow Tract* is obtained from "the parasternal long axis" view by tilting anteriorly or by rotating the transducer 45° anticlockwise from the FCV. This view demonstrates the presence of a great vessel originating from the left ventricle (Fig. 6) (1).
    - Ventricular septum should continue with the wall of the aorta.
    - Aortic valve should move freely and must have a fibrous continuity with the anterior leaflet of the mitral valve.
    - This view helps visualize the outlet type, apical ventricular septal defects, ventricular septal defects and conotruncal abnormalities which cannot be diagnosed from the four-chamber view.
2. *Right Ventricular Outflow Tract* can be obtained by further 45° rotation in the same direction from "the parasternal short axis" view (Fig. 7). The pulmonary artery is then visualized as a longitudinal (structure wrapping around a central-circular aortic root) and bifurcating vessel that is also called "the pulmonary bifurcation" view [1].
    - The pulmonary artery should divide into the right and left pulmonary artery and the ductus arteriosus. These divisions of the vessel arising from the right ventricle must be demonstrated in order to confirm the artery arising from right ventricle is indeed the pulmonary artery.
    - The pulmonary valve should move freely and there should not be any flow disturbance across the valve.
    - Both arteries, the aorta and the pulmonary artery, are approximately equal in size.
    - They originate from their respective ventricles and cross each other at a right angle.

Three Vessel and Three Vessel Trachea Views

Three-vessel and three-vessel trachea views are also helpful in the diagnosis of cardiac malformations.

- Three vessels are (from the left to the right) the pulmonary artery, ascending aorta, and superior vena cava.

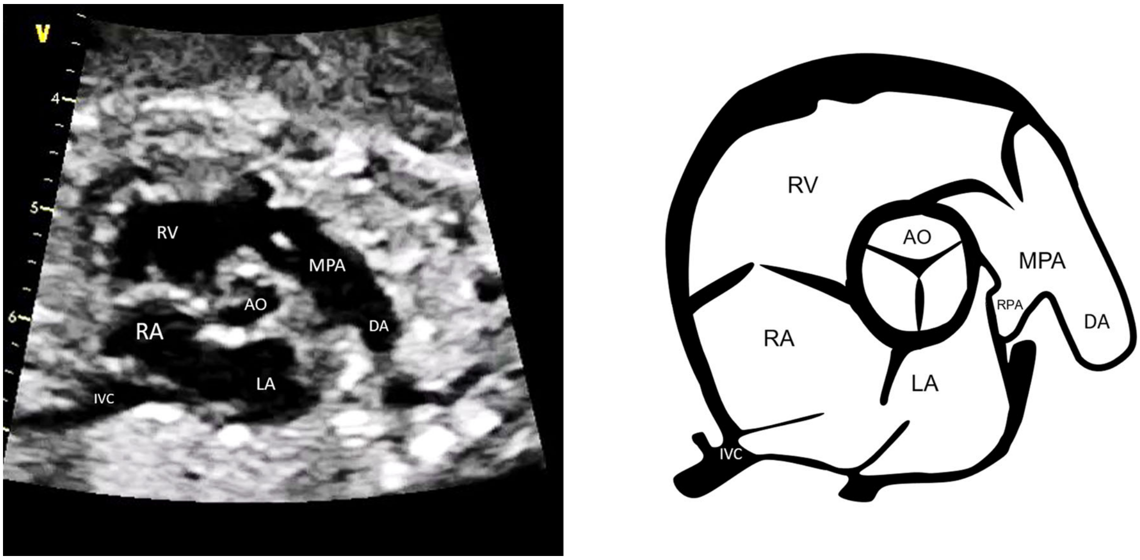

Fig. 7 *Right* ventricular outflow tract view. This view is very helpful in demonstrating great vessel orientation, size and the integrity of semilunar valves

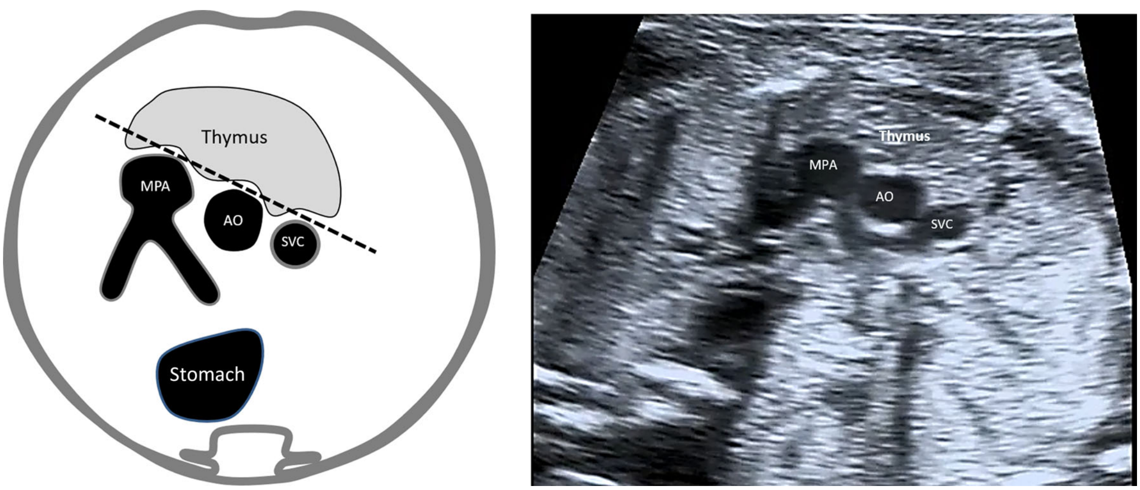

Fig. 8 Three-vessel view. This view shows, from the *left* to the *right*, pulmonary artery, aorta and superior vena cava

- These views help to evaluate the sizes and relationships of these three vessels (Fig. 8).
- The pulmonary artery is the most anterior one and should be the same size as the middle vessel which is the aorta. The superior vena cava is the one that is located the most posteriorly.
- The sizes of these three vessels decrease from the left to the right, which means that the pulmonary artery is the largest and the vena cava superior is the smallest vessel.
- These three vessels must be aligned along the same straight line.
- Color flow Doppler mostly (depending on the probe location) show the same direction of color in pulmonary and aortic vessels (no reverse flow should be seen).
- The aorta takes an oblique course towards the left of the trachea and forms a "V" shape with the ductus arteriosus (Fig. 9).

Sagittal Ductal and Aortic Arch Views

These views are commonly utilized to identify normal ductal and aortic arches by positioning the probe either in the fetal abdomen or at the jugular fossa or at the back of the fetal neck on a sagittal plane (Fig. 10) [1]. It provides more accurate anatomical information on the presence of aortic interruption or coarctation but has its limitations in the diagnosis of vascular rings. The three vessel trachea

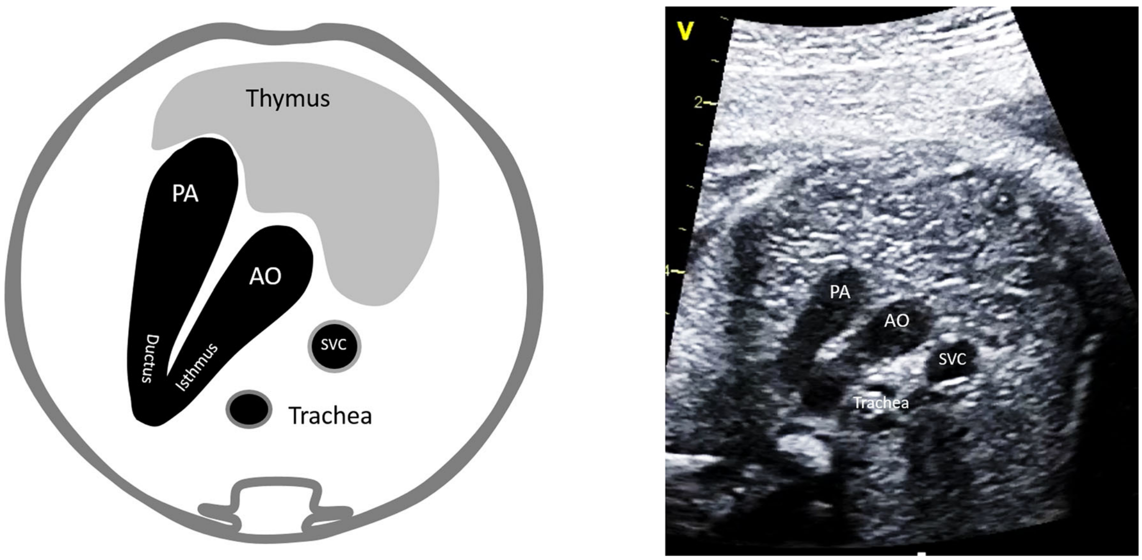

Fig. 9 The three vessel and trachea view. This view shows aorta crossing the midline to the *left* of trachea and forming a V shape with the pulmonary trunk

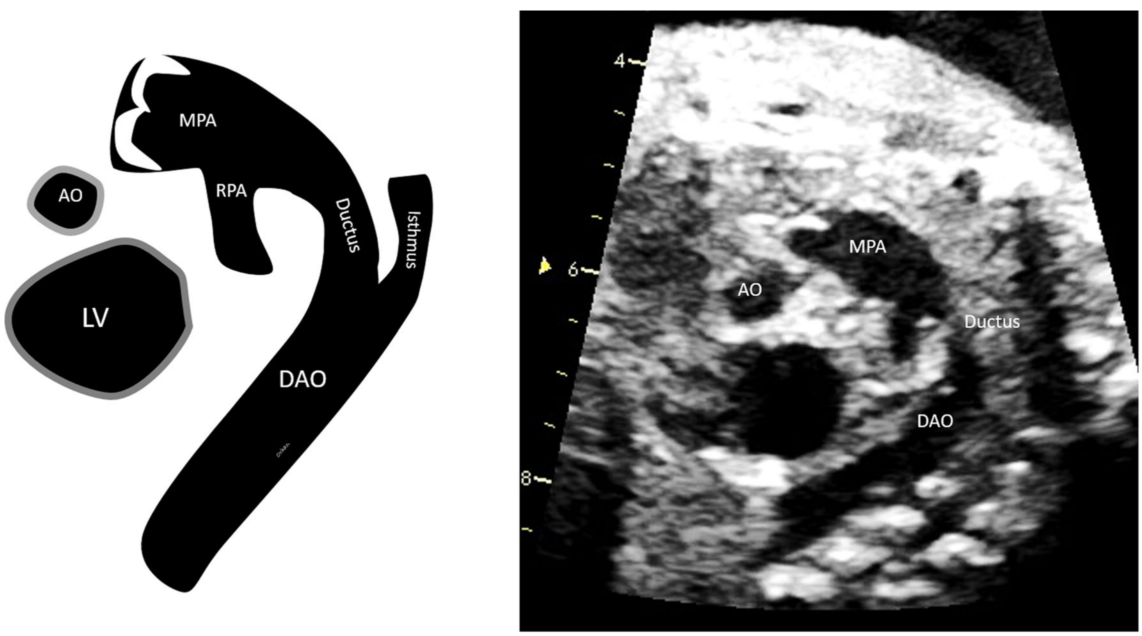

Fig. 10 Sagittal ductal arch view. This view is a gold standard plane to show the ductus arteriosus, the pulmonary artery, and the descending aorta

view and sagittal arch views can complement each other in the diagnosis of outflow tract, aortic arch, and great vessel orientation anomalies.

- The ductal arch arises from the anterior ventricle close to the chest (Fig. 11).
- The ductal arch takes a straight line towards the spine like a golf club and connects with the descending aorta.
- The ductal arch trifurcates into the right and left pulmonary arteries, and the ductus arteriosus.
- The aortic arch originates from the posterior ventricle and emerges upwards from the middle of the chest.
- The aortic arch takes a rounder course towards the neck resembling a "walking stick" or a "candy stick".
- The aortic arch does not bifurcate but rather gives rise to the head and neck vessels from its superior surface (Fig. 11).

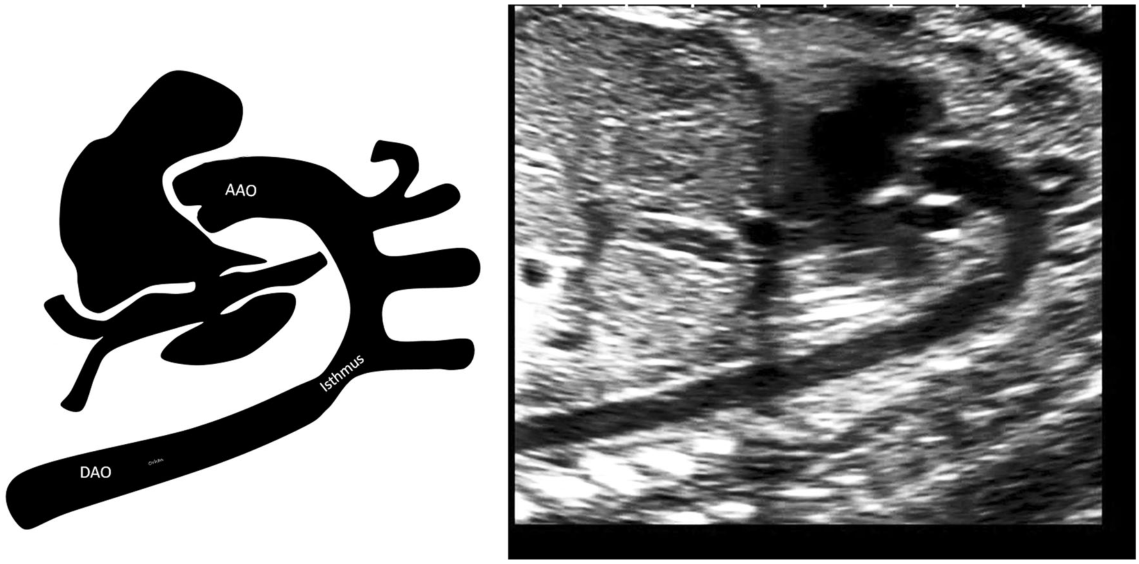

Fig. 11 Sagittal aortic arch view. This view is the gold standard plane to show aortic arch pathologies such as coarctation and interruption

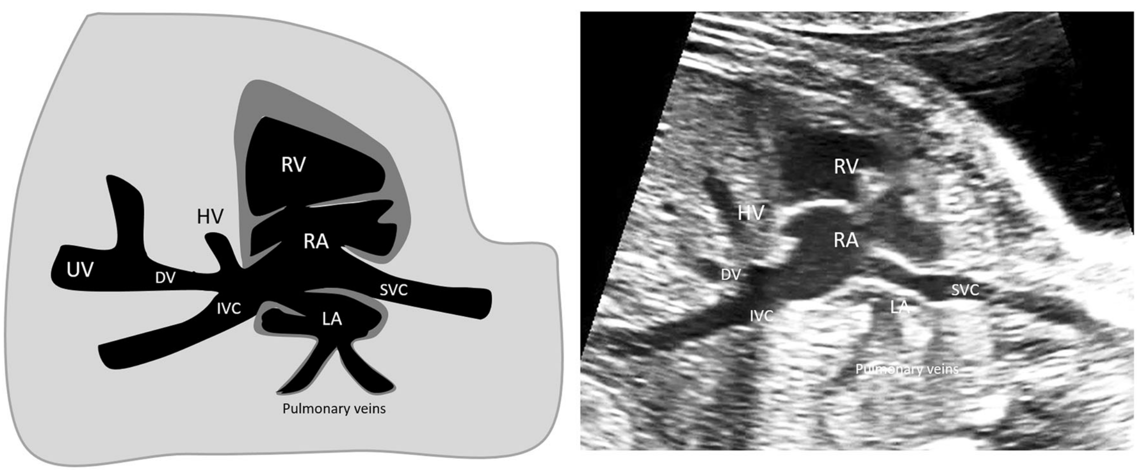

Fig. 12 Sagittal bicaval view. This view shows inferior and superior vena cava connection to the *right* atrium, the ductus venosus, the foramen ovale and the pulmonary veins

Sagittal Bicaval View

This view is an essential part of fetal cardiac examination to document normal systemic venous return to the right atrium (Fig. 12).

- The inferior vena cava has an intrahepatic part which receives the hepatic veins, and the ductus venosus flow.
- The inferior vena cava is of the same size as the superior vena cava.
- The superior vena cava connects to the right atrium from above.
- The ductus venosus flow is directed to the left atrium via the Eustachian valve.

Assessment of Fetal Cardiac Anatomy at the 11–14 Weeks Ultrasound Scan

Ultrasound scan at 11–14 weeks of gestation can be achieved in expert hands and has several targets; to confirm gestational age [2], to assess chorionic and placental status in multiple pregnancies [3], to measure nuchal translucency for aneuploidy screening [5, 15], and to evaluate other markers of aneuploidy and fetal anatomy (including cardiac structures) [6]. Visualization of cardiac anatomy at 11–14 weeks by ultrasound is rarely attempted only by experts in fetal echocardiography and has been limited mainly to high-risk patients [8]. The four-chamber view can be obtained in 90 % [9] of fetuses at 12 weeks and up to 100 % of fetuses between 13 and 15 weeks [10], but the other views may not be easy to visualize at these gestational ages. Nonetheless, one can evaluate the cardiac axis, heart rate, rhythm, the foramen ovale and four chambers with their comparative sizes at 11–14 weeks. The diameters of the two ventricles are similar and they increase linearly with gestation from about 1.5 mm at 11 weeks to 3 mm at 14 weeks; the area of the heart is about one-third of the chest and that ratio does not change with gestation [11]. Previously published reports show that atrioventricular canal defect [12], ventricular septal defect [13, 14], pericardial effusion [13, 14], overriding aorta [14] and ectopia cordis [10] are abnormalities that can be diagnosed during 11–14 weeks scan.

Evaluation of the fetal heart at 11–14 weeks combined with nuchal translucency measurement may be more valuable as 56 % of major abnormalities of the heart and great arteries were found in the subgroup with nuchal translucency above the 95th centile [2, 15]. However, nuchal translucency thickness above the 99th centile may offer better cut-off for identifying high-risk patients with fetal heart anomalies prompting an earlier referral to a specialist for fetal echocardiography.

Conclusion

The detection of cardiac anomalies is a challenging aspect of fetal ultrasonography owing to the small size of the fetal heart. Furthermore, its complex morphology and constantly moving parts make assessment of the fetal heart even more difficult. Cardiac anatomy can be evaluated during the first trimester with ultrasound at 11–14 weeks. However, evaluation of the four-chamber and outflow tract views of the heart during the midtrimester anomaly scan is now the standard approach for anomaly screening in most centers. Identifying the high-risk patients for congenital heart anomalies is a real challenge. The patients in whom possibility of congenital heart disease is suspected by a screening sonographer during a routine 20 weeks anomaly scan has a higher positive yield rate for an abnormality than any other proposed referral criteria for a specialist heart scan by a fetal cardiologist. Thorough ultrasound assessment of the fetal heart requires time and attention to detail. The operator must have the knowledge and expertise to recognize normal fetal cardiac anatomy and function in order to notice any deviation from normality. Establishing effective and functioning clinical pathways are of utmost importance for referrals and communication between screening sonographers, fetal medicine specialists, and fetal cardiologists. When a fetal cardiac defect or an arrhythmia is suspected on an anomaly scan (or the heart "does not seem to be normal"), ultrasound operators should have no difficulty in referring such patients for detailed fetal echocardiography.

Compliance with Ethical Standards

Conflict of interest None.

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