ORIGINAL RESEARCH PAPER INTERNATIONAL JOURNAL OF PURE MEDICAL RESEARCH

Radio-Diagnosis

KEYWORDS: Congenital heart diseases, ASD, VSD, TOF, TGA, four chamber view, three vessel view, three vessels with trachea view.

EARLY PRENATAL DETECTION OF CONGENITAL HEART DISEASES USING FETAL ECHOCARDIOGRAPHY: OUR FINDINGS WITH REVIEW OF LITERATURE

Volume - 9, Issue - 1, January - 2024 ISSN (O): 2618-0774 | ISSN (P): 2618-0766

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ABSTRACT

Introduction: Congenital heart diseases (CHD) are among the most common form of birth defects. The fetal cardiac screening by ultrasound can detect a high proportion of cases of CHD. Detection of cardiac anomalies can be challenging and is typically done by fetal cardiac ultrasound performed between 18 and 22 weeks. A transvaginal scan can detect anomalies even at 12–13 weeks. Early and precise detection of CHD can direct appropriate management.

Objectives: To detect the incidence of congenital heart diseases at a tertiary care centre and to detect cardiac anomalies early, accurately, and help avail all the benefits of early prenatal diagnosis.

Methods: A descriptive cross-sectional study, where 5,000 patients were screened over a period of 10 months who came for routine second trimester (16 to 24 weeks) obstetric evaluation. The fetal heart was evaluated and sequential segmental analysis was done using ultrasonography. Detailed biometric and structural evaluations of all fetuses were undertaken. In high-risk cases (17%), or in cases with positive cardiac findings, the extended fetal echocardiographic examination was performed at 16-20 weeks(850 cases). Follow-up scans were done at 24 weeks and post-natal periods to confirm the diagnosis. Out of 5,000 screened cases, 25 fetuses had CHD. The most common indication for extended fetal echo was maternal (59.2%) followed by fetal (40.2%). In maternal indications, the most common was advanced maternal gestational age (>35 years), followed by bad obstetric history and gestational diabetes. In fetal indications, the most common was abnormal obstetric Doppler findings favouring IUGR.

Results: Of 5,000 cases examined by us, at 16 – 24 weeks using Color Doppler, and a high-end ultrasound machine, we could diagnose VSD in 3 cases, ASD in 2 cases, TOF in 2 cases, Transposition of great vessels in 2 cases, Hypoplastic left heart syndrome in 2 cases, Ebstein's anomaly in 1 case and severe fetal hydrops with bradycardia in 1 case. On follow-up scan at 24 weeks, 2 additional VSD cases, 2 additional ASD cases, 2 new cases of TOF, and 1 new case of TGA were diagnosed. However, the number of cases of other pathologies remained the same. On post-natal scan additional cases of VSD, TOF and TGA diagnosed were 2, 1, and 2.

Conclusion: An apparently normal appearance at any stage of pregnancy does not exclude a major heart defect, and it seems likely that some defects may be amenable to diagnosis only after birth. Hence follow-up scans with minute observation and technical expertise are need of the hour. Most of the CHDs in our region are missed, primarily because of poor socioeconomic status, lack of availability and awareness of diagnostic echocardiography. Spreading awareness and skill of fetal echocardiography is need of the hour.

INTRODUCTION

Congenital heart diseases (CHD) are among the most common form of birth defects. The incidence of CHD is about 8 to 10 per 1000 live-born, full-term births, and it could as high as 8.3% in preterm infants [1, 2]. Furthermore, in early gestation, this incidence is even higher as certain CHDs are complex and have been show to result in fetal demise. In fact, 50%–60% of the CHD will require surgical correction and of these, 25% are critical with CHD a leading cause of infant mortality [3,4]. In this setting, the survival, extensive medical care, and developmental disabilities depend on the time of the diagnosis, on the delay of the treatment, and on the severity of the CHD. Therefore, it is necessary for a treatable CHD to be detected early which eventually results in reduction of perinatal morbidity and mortality [5]. As the preventable causes of infant mortality are decreasing, comparative proportion of CHD is increasing. Our hospital tends to cases from largest populated state of one of the largest populated country in the world.

Detection of cardiac anomalies can be challenging and is typically done by fetal cardiac ultrasound performed between 18 and 22 weeks. Transvaginal scan can detect anomalies even at 12–13 weeks. All the ultrasounds were done by Radiologists. Most of the primary ultrasounds were done by corresponding author and senior Radiology trainees. In cases of doubt, second opinion and guidance was taken by senior consultants. Detailed fetal echocardiography with Doppler was performed in high-risk cases. High risk cases were labeled either according to fetal indication (extra cardiac anomalies, increased nuchal translucency, hydrops, or polyhydramnios), maternal indication (advanced maternal age, diabetes or gestational diabetes, teratogen exposure, bad obstetric history, metabolic disorders, congenital heart defect, or autoantibodies), or familial (sibling or father with congenital heart defect and Mendelian syndromes) factors. Detection of anomalies alters the obstetric course and outcome, including reassurance, termination, fetal therapy, mode of delivery, and postnatal referral to a tertiary care center with advanced expertise in management of these

patients [6]. Cardiovascular development involves a complex process in which genetic and environmental factors are involved. Women may not take precautionary actions against environmental factors as approximately 49 % pregnancies are unplanned [7]. The detection of CHD by fetal echocardiography when referred by a suspicion of cardiac abnormality on routine obstetric ultrasound is up to 40% in low-risk populations. However, risk factors are identified in only 10% of CHD. In this scenario, the heart should be examined in detail on a routine sonographic scanning by trained radiologist.

The fetal cardiac screening by ultrasound can detect a high proportion of cases of CHD. The sensitivity of four chamber view to detect fetal cardiac anomalies is approximately 30%. It is inadequate to detect many cases of CHD, especially conotruncal and outflow defects (ex: transposition of the great vessels, tetralogy of Fallot, double-outlet right ventricle, truncus arteriosus, and outlet septal defects). When the evaluation of outflow tracts was added to the four-chamber view, the sensitivity of ultrasound screening for CHD increased from approximately 30% to 69%–83%[8]. Currently, the three vessels (3V) ,and 3 V with trachea (3VT) views were added to the standard four-chamber and outflows views in order to improve the detection of CHD[9]. The latter one enabled the detection of lesions such as coarctation of the aorta, right aortic arch, double aortic arch, and vascular rings, achieving a prenatal detection rate of congenital heart disease to up 90%.

The average time to obtain the cardiac views was just over 2 min, but in approximately one third of cases, the cardiac examination was postponed by 15–20 min due to unfavorable fetal lie (anterior spine) [10]. A fetal echocardiogram should be performed if the CHD is suspected on the obstetric cardiac of screening, or if there is a recognized increased risk (maternal, fetal and/or familial factors) for CHD >2% to 3%. Common technical difficulty was frequent fetal movement, which was more specially if mother was empty stomach.

Early and precise detection of CHD can result in early appropriate management. In – utero surgical interventions have been made possible by the advancement in the field of medicine. Pregnant women who carry anomalous fetuses can be counseled regarding the fetal anomalies and they can be sent to neonatal pediatricians for an early management or they can be advised to go for termination of pregnancy if the anomalies are lethal and of an incurable variety.

AIMS AND OBJECTIVES

To detect the incidence of congenital heart diseases in a tertiary care center. To detect cardiac anomalies early and accurately and help avail all the benefits of early prenatal diagnosis.

MATERIALS AND METHODS

The descriptive cross sectional study was undertaken in Radiodiagnosis department. A total of 5,000 patients came for second trimester (16 to 20 weeks) obstetric evaluation over a period of 10 months on high end ultrasound machine using curvilinear probe (2-6 MHz) and curved matrix 4D probe (5-8 MHz). Out of them high risk cases and cases with any positive finding (850 patients) underwent dedicated echocardiography, using colour & spectral Doppler on high end ultrasound machine (depicted in flowchart). It is well established that USG and Doppler is completely safe in pregnancy, with no untoward effects on mother or baby [2, 5, and 6]. These cases underwent repeat echocardiography at 24 weeks, and also post natally. The study was performed with routine informed consent of the patient in compliance with National Government rules and local regulatory authorities. Still images were taken and saved. Cine loops were not routinely saved due to time constraint.

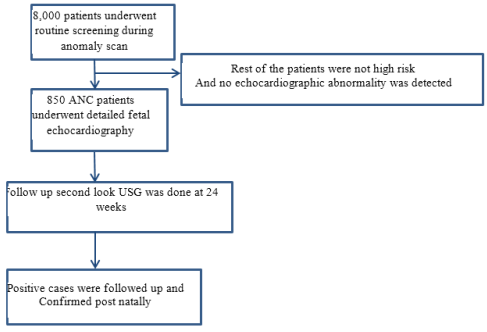
The fetal heart was evaluated and sequential segmental analysis was done using ultrasonography. Detailed biometric and structural evaluations of all foetuses were undertaken. Fetal lie, position was noted, and axial upper abdomen section was taken while deciding situs. Firstly situs was established using axial section along abdomen. Normal situs was labeled when stomach is on the left, aorta on the left near to the fetal spine, vena cava anterior and to the right of the fetal spine (Fig.1). This was followed by obtaining four-chamber view. Simple rotation of the probe (≈90°) along its axis brought the major great vessels into view allowing proper visualization of the left ventricle outlet, the short axis of the right ventricle axis with the main pulmonary artery, and the aortic arch and ductus. Atrio-ventricular connections - the four chamber view: - two atria and two ventricles with right atrium communicating with the right ventricle and left atrium communicating with the left ventricle (Fig.2 & 3).

On the four chamber view we should also check for the correct function and morphology:

- Cardiac size
- Cardiac Axis (ideally about 45 degrees)
- Pericardial effusions
- Regular rhythm
- Atrioventricular Valves
- Ventricular Identity - RV is more muscular and triangular with a moderator band

Ventricular - arterial connections and great vessels are evaluated. Fine wrist movements while doing sonography comprised of sliding and sweeping motion. They are labelled Concordant when Left ventricle (LV) continues into Aorta, and Right ventricle (RV) into Pulmonary Trunk (Fig.4 & 5).

Flowchart 1: Screening and detailed echocardiography protocol.



Regular sections obtained in all cases were:

4 chamber view: Both atria & ventricles noted . Veno- atrial, artio-ventricular and ventriculo-arterial concordence was checked.

5 chamber view: On slight craial angulation from 4 chamber view, axial section through ascending aorta is seen as additional fifth chamber .

3 vessel view: Mild cranial sweep shows axial section through Pulmonary artery, aorta and superior vena cava (from left to right , and in descending order of caliber)

3 vessel trachea view: slight craial angulation from 3 vessel view, additionally trachea becomes visible.

Left ventricular outflow tract: four-chamber view and rotate thumb toward baby's left shoulder, resulting in elongation of the left ventricle, until aorta is seen arising from the left ventricle. It is important cardiac plane as various conotruncal anomalies, such as tetralogy of Fallot and transposition of the great arteries are seen in it. Aorta and left ventricle were obtained in the same plane and normal thin aortic valve leaflets were visualized during cardiac cycle. Right ventricular outflow tract: After obtaining LVOT, 900 angulation away from left shoulder of foetus with slight craial angulation; pvovides RVOT. Right ventricle and pulmonary artery are obtained in the same plane and normal pulmonary valve leaflets were

visualised during the cardiac cycle. Bicaval hammock view:Sagittal view through right atrium, where superior and inferior vena cava are seen entering.

Additional views in extended echocardiography included:
Confirming any positive findings on screening echocardiography. Doppler study: Using colour/power doppler and spectral doppler. Cardiac biometry including size , volume, velocity and rhythem.

RESULTS

Among the 850 cases out of 5,000 cases, four chamber view/ outflow tracts were visualized at the 16-20 weeks scan, at 24 weeks and post natally. The 16–20 week scan using Colour Doppler, and a high end ultrasound machine we could diagnose VSD in 3 cases, ASD in 2 cases, Ebstein's anomaly in 1 case, Hypoplastic left heart syndrome in 2 cases, TOF in 2 cases ,TGA in 2 cases, severe fetal hydrops with bradycardia in 1 case. The 24 week scan showed additional 2 cases of ASD, 2 cases of VSD, 2 cases of TOF and 1 case of TGA. The post natal scan showed additional 2 cases of VSD, 1 case of TOF and 2 cases of TGA [Table 1].

Table 1: Summary of CHD detected on antenatal 2D Echocardiography, and post natal follow up.

	CHD Detected	16-20 weeks	24 weeks	Post Natal	Total cases
1	ASD	2	2	0	4
2	VSD	3	2	2	7
3	Ebstein's Anomaly	1	0	0	1
4	Hypoplastic left heart Syndrome	2	0	0	2
5	TOF	2	2	1	5
6	TGA	2	1	2	5
7	Severe fetal hydrops with bradycardia	1	0	0	1
					25

At 16-20 weeks cases of VSD diagnosed were 3, on follow up scan at 24 weeks the 2 additional cases of VSD were diagnosed. On post-natal scan 2 more cases of VSD were diagnosed which was missed on antenatal scan (Fig.6). The number of ASD cases diagnosed at 16-20 weeks and at 24 weeks remained 2 and 2 respectively, with no new addition post natally. Ebstein's anomaly was diagnosed in 1 case at 16-20 weeks (Fig.7). Hypoplastic left heart syndrome was diagnosed in 2 cases at 16-20 weeks. The number of TOF cases diagnosed at 16-20 weeks, at 24 weeks and post natally remained 2, 2, and 1 respectively(Fig.8). Similarly the number of TGA cases diagnosed at 16-20 weeks, at 24 weeks and post natally remained 2,1,and 2 respectively(Fig.9 & 10). Severe fetal hydrops with bradycardia was diagnosed in 1 case at 16-20 weeks.

DISCUSSION:

Fetal heart examination performed between 16-20 weeks can detect cardiac anomalies and thus patient can gain from early detection like early genetic counselling and pregnancy termination based on ultrasound findings. For more accurate diagnosis patient needs follow up scan around 24 weeks. Thus early screening in mid gestation is advised. The value of early screening is that it detects 64% of CHDs. ASDs occur in 1 per 1500 live births and comprise 6.7% of CHD in live-born infants. ASDs occur twice as often in females as males. In our study 2 cases of ASD was diagnosed at 16-20 weeks which increased by additional 2 more cases at follow up scan at 24 weeks. Isolated VSD is the most common cardiac anomaly, accounting for 30% of heart defects diagnosed in live-born infants and 9.7% diagnosed in utero. VSDs are associated with other cardiac anomalies in 50% of cases. In our study out of 850 patients the number of VSD cases diagnosed at 16-20 weeks, 24 weeks and post-natal scan were 3, 2 and 2. Ebstein's anomaly with atrialisation of right ventricle was noted in one case at 16-20 weeks. We diagnosed 2 cases of Hypoplastic left heart syndrome (HLHS) at 16-20 weeks. On follow up scans no additional cases of HLHS were detected. Tetralogy Of Fallot (TOF) accounts for 5% to 10% of CHD in live births and is associated with a variety of cardiac, extracardiac, and chromosomal anomalies. A study of 129 fetuses diagnosed in utero with TOF reported additional cardiac anomalies in 57%, extracardiac anomalies in 50%, and chromosomal anomalies in 49%. In our study , the number of TOF cases diagnosed at 16-20 weeks, 24 weeks and post-natal scan were 2, 2 and 1 with one being incompatible with life.TGA was diagnosed in utero , in fetuses at 16-20 weeks, 24 weeks and post-natal scan were 2, 1 and 2 cases. A single case of severe fetal hydrops with bradycardia was diagnosed at 16-20 weeks [10, 11, and 12].

Views in Fetal Cardiac Ultrasound
Upper abdomen and four-chamber views

The examination of the upper abdomen (cross-sectional plane) of the fetus by echocardiography provides the distinction between the left and the right sides of the fetus. When the situs is normal (solitus), the aorta and stomach are located on the left side and the inferior vena cava and liver are placed on the right. Therefore, situs solitus is the normal arrangement of thoracic and abdominal organs (Fig. 1). In general, more complex CHD are associated with abnormalities of the situs. Furthermore, the umbilical vein and the hepatic veins can be visualized in upper abdomen view. The four-chamber view is the most important plane. This approach enables the evaluation of the main cardiac structures, the position, the size (1/3 of the thorax), the contractility and the rhythm of the heart. In normal levocardia, 2/3 of the heart is left- sided with the axis pointing to the left (Fig. 2 & 3). Cardiac axis is at 45+/ -20 and abnormal axis is associated with chromosomal anomaly, abnormal displacement of the heart (diaphragmatic hernia or space-occupying lesion), and many CHD, especially in conotruncal anomalies and univentricular hearts[11]. Cardiomegaly can be evaluated by the global size of the heart and in small fetuses this should be done by cardiothoracic ratio (CTr = cardiac area/ thorax area). The size of the left and right chambers is similar. However, in the third trimester, mild over right-left asymmetry can be a normal variant.

Left and right ventricular outflow tracts

The outflow tracts view (five-chamber view) can be obtained from the four-chamber view by sliding the transducer to the fetal head that enables the identification of the origin of the great arteries. In a normal RV outflow view (RVOT), the pulmonary trunk can be visualized arising from RV and crossing the ascending aorta. The evaluation of LV outflow view (LVOT) and RVOT helps to identify outflow septal ventricular defects and conotruncal anomalies. The LVOT confirms the aorta arising from the morphological LV as a vessel continuing the outflow ventricular septum as well the aortic-mitral valve continuity(Fig. 4 & 5).

Three vessels and three vessels and trachea views

The three vessels (3 V) view is obtained from the four-chamber view by moving the transducer in the direction of the upper fetal and the pulmonary trunk; the arch with aortic isthmus and superior vena cava (SVC) can be visualized. [11]

Cardiac anomalies
Atrial septal defect:-

Atrial septal defect (ASD) is a common heart malformation occurring in about 10% to 15% of CHD after birth, and results from an abnormal embryologic development of the atrial septum. The types of ASD are: 1-secundum ASD; 2- primum ASD; 3- sinus venosus ASD; 4- coronary sinus ASD. A secundum ASD is the most common ASD (70%), located in the middle of the atrial septum. [12] Diagnosis of an ASD relies on the demonstration of a dropout of echoes at the level of the atrial septum. Because of the presence of the foramen ovale and the rapidly flapping valve, it is unlikely that a small ostium secundum defect can be recognized in the fetus. [13]

Ventricular septal defect(Fig. 6):-

Ventricular septal defect (VSD) is the most common CHD occurring in about 30% of neonates with CHD and 7% to 10% in utero. [14] Ventricular septal defects are classified according to their location on the ventricular septum as: 1- membranous (small segment close to the septal cusp of tricuspid valve and adjacent left heart valves); 2- muscular (lower 2/3 of theseptum); and 3- subarterial doubly committed (supracristal). The diagnosis depends on the demonstration of a dropout of echoes at the level of the interventricular septum [15, 16]

Atrioventricular septal defect(Fig. 6):-

The atrioventricular septum defect (AVSD) refers to a group of cardiac malformations resulting from a defect of atrioventricular septum that may lead to defects of the interatrial septum (ostium primum ASD) of the interventricular septum (inlet VSD), and the division of the atrioventricular valves. AVSD is also known as atrioventricular canal defect or endocardial cushion defect. [17] The diagnosis of complete AVSD relies on demonstration of the defect of the inferior portion of the atrial septum and of the superior portion of the ventricular septum. The presence of a common leaflet at the level of the atrioventricular valve can also be detected and allows differentiation between complete and incomplete forms. [18-20]

Ebstein anomaly(Fig. 7):-

Ebstein's anomaly is characterized by the lack of mobility and downward displacement of septal and posterior cusps of TV (gap between the TV and the mitral valve >8 mm). [18] The main criterion for diagnosis is demonstration of downward displacement of the tricuspid valve into the right ventricle. The right atrium is generally extremely enlarged. [19,20]

Tetralogy of fallot(Fig. 8):-

The tetralogy of Fallot is characterized by: 1- a VSD; 2- an overriding aorta; 3- infundibular pulmonary stenosis; and 4- right ventricular hypertrophy. However, in utero, the RV hypertrophy is almost always absent and the four-chamber cardiac view is normal. The diagnosis relies on demonstration of a dilated aorta overriding the interventricular septum. [17] Studies have shown that there is no sonographically detectable hypertrophy of the right ventricle in the midtrimester. [15,16].

Transposition of great vessels(Fig. 9 & 10):-

The transposition of the great arteries (TGA) is a frequent cyanotic CHD characterized by discordant ventriculoarterial connection, in which the aortic artery arises from the RV and the pulmonary artery from the LV. The diagnosis rests on the absence of the normal anatomic criss-crossing of the aorta and pulmonary arteries, which arise from the ventricles in a parallel fashion. This finding can be demonstrated either in a long axis view of the ventricles or a short axis view of the great vessels. The aorta and pulmonary artery can be positively identified by following the course of the vessels to the arch and to the bifurcation into the left and right pulmonary artery, respectively. [10]

Severe fetal hydrops with bradycardia was diagnosed in 1 case at 16-20 weeks (Fig.11).

Truncus arteriosus:-

Truncus arteriosus is a rare condition (1.5% of CHD in newborns) in which only a single arterial arises from the ventricles and gives flow to the systemic, pulmonary and coronary circulations. Truncus arteriosus is characterized by the presence of a single arterial vessel overriding the ventricular septum. [11]

Double outlet right ventricle:-

Double-outlet right ventricular outflow tract (DORV) refers to a group of heart defects in which both great arteries arise predominantly (>50%) from the morphologically right ventricle. A specific diagnosis of DORV is difficult, since the findings may closely resemble tetralogy of Fallot or TGA with VSD[12] .

Hypoplastic right ventricle:-

Develops due to reduction in blood flow secondary to inflow impedance from tricuspid atresia or outflow impedance from pulmonary arterial atresia. [13] In the fetus, both ventricles should be of equal size. Logically, recognition of HRV depends on the demonstration of a small right ventricular cavity. Nomograms of the inner dimensions of the ventricular chambers obtained with real-timel2 and M-model echocardiography are available. [14]

Hypoplastic left heart syndrome:-

The most common sign of aortic atresia is the hypoplastic LV, detectable as an echogenic and dysfunctional chamber in the four-chamber view. In fetuses with classic forms of HLVS (aortic and mitral atresia), there is a markedly abnormal four-chamber view at mid-gestation, with no inflow into the left ventricle (mitral atresia) and a severely hypoplastic LV. In the fetus, both ventricles should be of equal size. Logically, recognition of HLHS depends on demonstration of a small left ventricular cavity. [14-17]

Univentricle heart:-

Two atria empty into a single ventricle via 2 A-V valves or a common A-V valve. The diagnosis of double inlet univentricular heart relies on the demonstration of two atrioventricular valves connected to a main ventricular chamber. Ultrasound may also demonstrate the presence and position of a rudimentary chamber and the ventriculoarterial connection. [18]

Coarctation of aorta:-

Coarctation of the aorta represents a narrowing of the aortic arch and, in general, it is located between the origin of the left subclavian artery and the ductus arteriosus (aortic isthmus). The diagnosis of coarctation of the aorta relies on demonstration of a narrowing of the vessel in the isthmal region, which may be associated with proximal or distal dilatation. [19]

Aortic stenosis:-

Valve aortic stenosis is the most common type of aortic stenosis occurring in 60%–70% of patients with aortic stenosis. Supravalvar and subaortic stenosis are rare in fetuses and at least one can be associated with mitral valve disease and coarctation of aorta, also known as Shone syndrome (left-sided heart obstructive lesions). A prenatal diagnosis is extremely difficult. The condition should be suspected when there is either enlargement or hypoplasia of the left ventricle or ascending aorta. [20]

Pulmonary stenosis:-

There is stricture or obstruction of the RIGHT ventricular outflow tract. A prenatal diagnosis is extremely difficult. The condition should be suspected when there is either enlargement of the pulmonary artery or reduction in size of the right ventricle. [9,10]

CONCLUSION:

Fetal anomalies can vary in appearance over time, and the fetal heart provides a critical example for this notion. Although comprehensive fetal cardiac anatomy can be assessed by the end of the second trimester, alterations in chamber size, minute VSDs, and differences in size between the great vessels may not become apparent until later in fetal or neonatal life. An apparently normal appearance at any stage of pregnancy does not exclude a major heart defect, and it seems likely that some defects may be amenable to diagnosis only after birth. Skill of fetal echocardiography and its utility should be spread at community level.

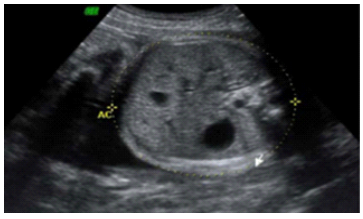


Fig.1 Normal situs was labelled when stomach is on the left, aorta on the left near to the fetal spine, vena cava anterior and to the right of the fetal spine.

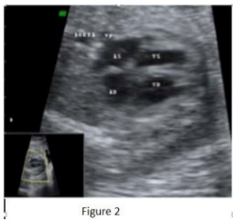


Figure 2

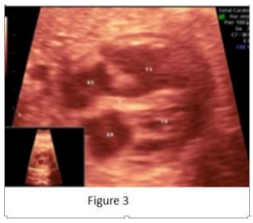


Figure 3

Fig.2 & 3. Atrio-ventricular connections - the four chamber view: two atria and two ventricles with right atrium communicating with the right ventricle and left atrium communicating with the left ventricle

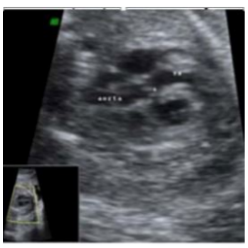


Figure 4

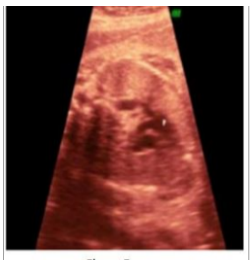


Figure 5

Fig.4 & 5. Ventricular-arterial connections and great vessels are evaluated. They are labelled Concordant when Left ventricle (LV) continues into Aorta, and Right ventricle (RV) into Pulmonary Trunk.

Fig.6 VSD. 25wks of gestation came for routine antenatal check up Fetal echocardiographic showed: e/o 3 mm defect in membranous portion of interventricular septum on lateral four chamber view. There seems to be shunting of blood across the defect. Rest of the findings were within normal limits. All the four chambers appear normal in size and dimensions. Inflow and outflow tracts were normal. All the valves were normal in b mode and on colour Doppler

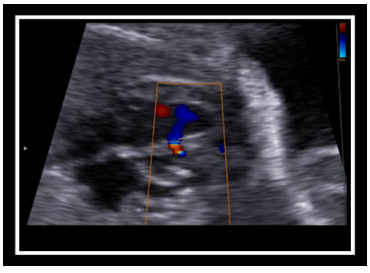


Fig.7 Ebstein anomaly. A 26 yrs old woman with 29 wks. of gestation was referred for routine antenatal check-up. The ultrasonography scans at the level of thorax shows a massive dilatation of right atrium. Tricuspid valve is displaced apically in right ventricle. Color Doppler showed tricuspid regurgitation. The pulmonary outflow shows pulmonary atresia. Left atrium and ventricle appears normal and outflow and inflow tracts shows normal Doppler parameters. .

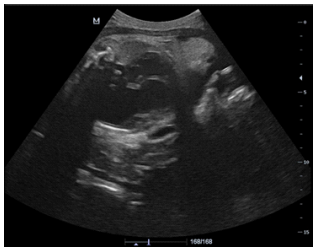


Fig.8 TOF. 27 year old woman with 24 weeks of gestation. Present USG scan shows Membranous VSD with overriding aorta. Small sized pulmonary artery (lesser pulmonary diameter than aortic diameter) with hypertrophy of RV.

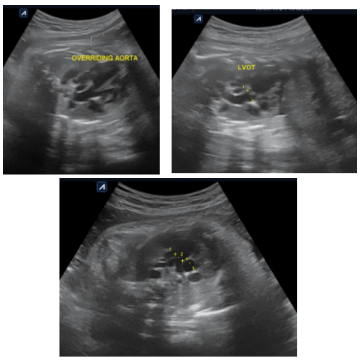


Fig 9: TGA

A 25 yrs old presented for routine antenatal check-up at 20 weeks.Fetal echocardiographic examination showing side by side relation of aorta and pulmonary artery and reversal of position. Associated VSD is also noted.

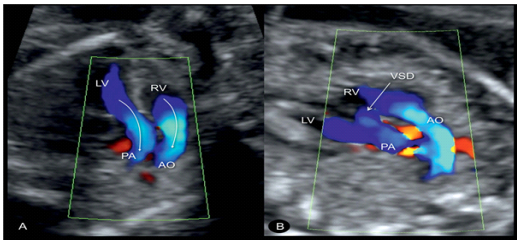


Fig 10: Corrected TGA with double discordance

A 25 years old pregnant woman presented for routine antenatal checkup at 20 weeks. Sonography shows transposition of great arteries and aorta is arising from the right and pulmonary trunk is arising from left of the fetus. Aorta is identified by its arch giving brachiocephalic trunk. Pulmonary artery bifurcates into right and left .vessels are in parallel configuration .The ventricle on the left of the fetus shows moderator band and shows thick trabeculations and is morphological right ventricle. The ventricle to the right side of the fetus lying anteriorly behind the chest wall and sternum is likely morphological left ventricle.

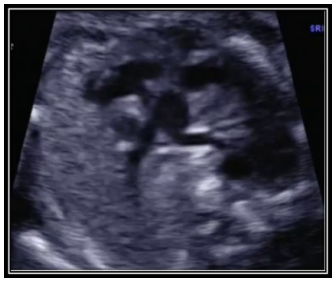
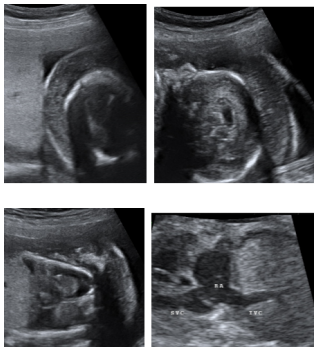


Fig 11: 37 year old woman came for routine antenatal scanning at 20 weeks of gestation. USG revealed severe subcutaneous tissue thickening with pleural and pericardial effusion, and ascitis. Severe bradycardia was also noted. Findings were suggestive of fetal hydrops.



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