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ROLE OF ULTRASONOGRAPHY IN EARLY DETECTION OF FETAL CARDIAC ANOMALIES

Radiodiagnosis

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ABSTRACT

AIMS AND OBJECTIVES- To detect cardiac anomalies early and accurately and help avail all the benefits of early prenatal diagnosis.
MATERIALS AND METHODS- We enrolled 50 patients and tried to evaluate the heart (four chambers and great vessels) in them who came for the second trimester evaluation (16 to 24 weeks of gestation).All ultrasound exams were performed on GE healthcare's LOGIC F8 machine.
RESULTS- Screening ultrasonography done in second trimester revealed simple anomalies or a combination of simple anomalies. Correct heart scanning is possible at 16 – 24 weeks, but needs an experienced sonographer, who masters the Colour Doppler, and a high end ultrasound machine.

KEYWORDS:

Ultrasonography, cardiac anomalies

Introduction:
Congenital cardiac disease is seen in 2–6.5 of 1000 live births and is a major cause of morbidity and mortality, with half of these cases being lethal or requiring surgical correction. Environmental, genetic, and chromosomal abnormalities are believed to be causes of congenital cardiac defects, with a higher incidence among infants with affected siblings or mother. Extra cardiac abnormalities are associated with 25% of these cases. Detection of cardiac anomalies can be challenging and is typically done by ultrasonography performed between 16 and 24 weeks. Detection of anomalies alter 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.

Methodology:
Today the method of choice to exam the fetal heart is sequential segmental analysis which can detect simple or a combination of simple anomalies. Detailed biometric and structural evaluations of all fetuses were undertaken. In all cases and on all occasions, the extended fetal echocardiographic examination was performed.

First establishing situs

⬇

Obtaining four-chamber view was visualized

⬇

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.

➡ **Step 1 – establishing the situs**
The normal image - stomach on the left, aorta on the left near to the fetal spine, vena cava anterior and to the right of the fetal spine - corresponds to situs solitus. (Figure. 1)

Figure. 1

➡ Atrio-ventricular connections - the four chamber view: - Two atriae - Two ventricles - Right atrium communicates with the right ventricle - Left atrium communicates with the left ventricle

Figure 2

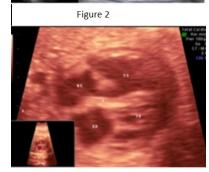


Figure 3

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

- Cardiac size (about one third of the thoracic area)
- 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 – great vessels evaluation:
Concordant: Left ventricle (LV) - Aorta, Right ventricle (RV) - Pulmonary Trunk

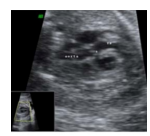


Figure 4

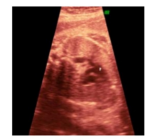


Figure 5

Discordant : -TGA (transposition of great vessels)
- "Double outlet ventricle"
- "Single outlet heart" but with multiple pathological variants:

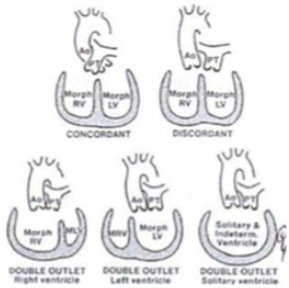


Figure 6

The three vessels and trachea view completes the great vessels evaluation:

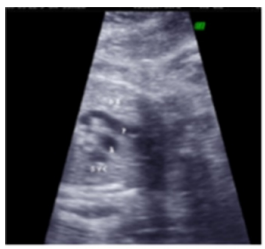


Figure 7

Figure 8

Discussion:

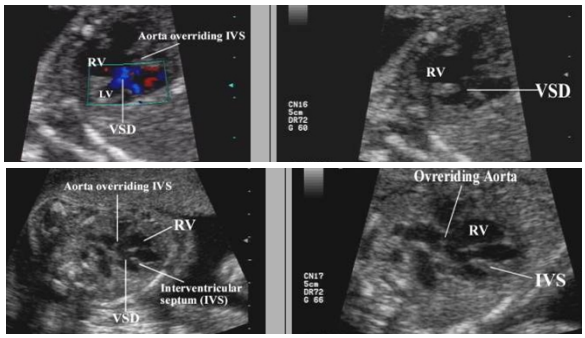
Fetal anomalies can vary in appearance over time, and the fetal heart provides a critical example for this notion. Although comprehensive fetal cardiac anatomy can be assessed by the end of the second trimester alterations in chamber size, minute VSDs, and differences in size between the great vessels 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.

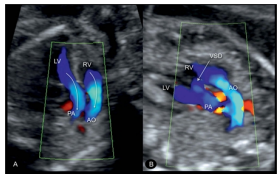
Obtaining the four chamber view/ outflow tracts at the 16-20 weeks ultrasound and at 24 weeks ultrasound:

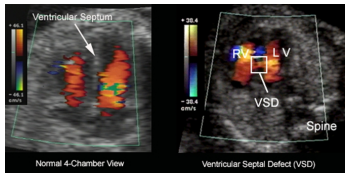
Cohort	Number of cases	Four chamber view	Outflow tract
16-20weeks	50	45	33
24 weeks	50	50	46

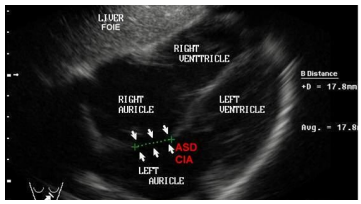
VSDs are probably the most commonly missed lesions during prenatal echocardiographic examinations. The small size of most of these lesions is apparently beyond the resolution of most currently available gray-scale ultrasound scanners. Therefore, the prenatal diagnosis of VSD is often very difficult.

Observations made by us have indicated that some lesions tend to undergo progression in utero. Examples for such lesions include major vessel stenosis and ventricular outflow tract obstruction. These forms of obstructive outflow tract lesions may not be obvious in the first half of pregnancy, mainly because the process of arrest of growth in narrowing the vessel is not significant enough to be detected by bidimensional ultrasound scanning.





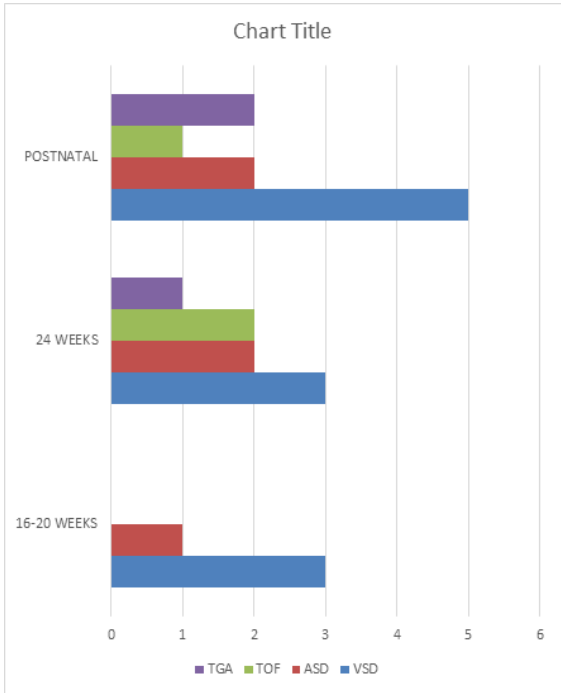




Of 50 cases examined by us, at 16 – 24 weeks using Colour Doppler, and a high end ultrasound machine we could diagnose following cardiac anomalies-

VSD – 3 CASES
ASD- 2 CASES
TOF – 1 CASE

Transposition of the great vessels- 2 CASES



CARDIAC ANOMALIES

1) VSD: - At 16-20 weeks cases of VSD diagnosed were 3, on follow up scan at 24 weeks the number of patients diagnosed with VSD remained the same. On post-natal scan one more case of VSD was diagnosed … which was missed on antenatal scan.

2) ASD :- At 16-20 weeks cases of ASD diagnosed were 2 , on follow up scan at 24 weeks the number of patients diagnosed with ASD were 3 and on post-natal scan the number of patients diagnosed with ASD were 3 as diagnosed on 24 weeks and missed at 16-20 weeks

3) TETRALOGY OF FALLOT :- No case of TOF was diagnosed at 16-20 weeks , on follow up scan at 24 weeks the number of patients diagnosed with TOF were 2, on post-natal scan only 1 case with TOF was diagnosed as the severity of the disease was not compatible with the life

4) TRANSPOSITION OF THE GREAT VESSELS :-

none of the case of TGA was diagnosed at 16-20 weeks , on follow up scan at 24 weeks the number of patients diagnosed with TGA were 1, on post-natal scan total 2 cases of TGA were diagnosed out of which one was missed at 24 weeks usg.

Conclusion:

Special attention should be given to the stage of pregnancy in which fetal heart examination is performed. Early screening in midgestation is advisable. Nevertheless, the value of early screening is that it detects 64% of CHDs; therefore, there is a unique opportunity for early genetic counseling and pregnancy termination based on ultrasonic findings.

Fetal cardiac anomalies can vary in appearance at different stages of fetal development and may evolve in utero during the course of pregnancy. About 20% of CHDs may not be identified by a comprehensive fetal echocardiographic examination during the early second-trimester. The early second-trimester fetal cardiac examination should always be followed by a midgestation scan, which facilitates detection of an additional 17% of cardiac anomalies that would not have been evident at the beginning of the second trimester. Further examinations during the late second or third trimester of pregnancy may increase the detection rate of CHDs.

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