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Three three-vessel trachea view in diagnosing congenital heart disease in foetus at 18-20 weeks of gestation in correlation with standard four chambered view

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Abstract
Objective: *To include three vessel tracheal view in routine antenatal anomaly scan in 18-20 weeks of gestational age.*
To utilize three vessel view in diagnosing various congenital heart defects.
To assess the effectiveness of three vessel tracheal view in comparison with routine four chamber view which is included in foetal anomaly scan.
To assess the overall sensitivity of three vessel tracheal view, four chambered view and combined in detection of cardiac defects in foetuses.
Results and conclusion: *500 mothers were examined. Including 3vessel tracheal view in normal cardiac screening in antenatal mothers during 2nd trimester significant number of cases are identified, cases which require early postnatal care can be segregated in a better way as compared to using only 4 chambered view in which some abnormalities would be missed giving rise to grave prognosis for foetus.*

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I. Introduction

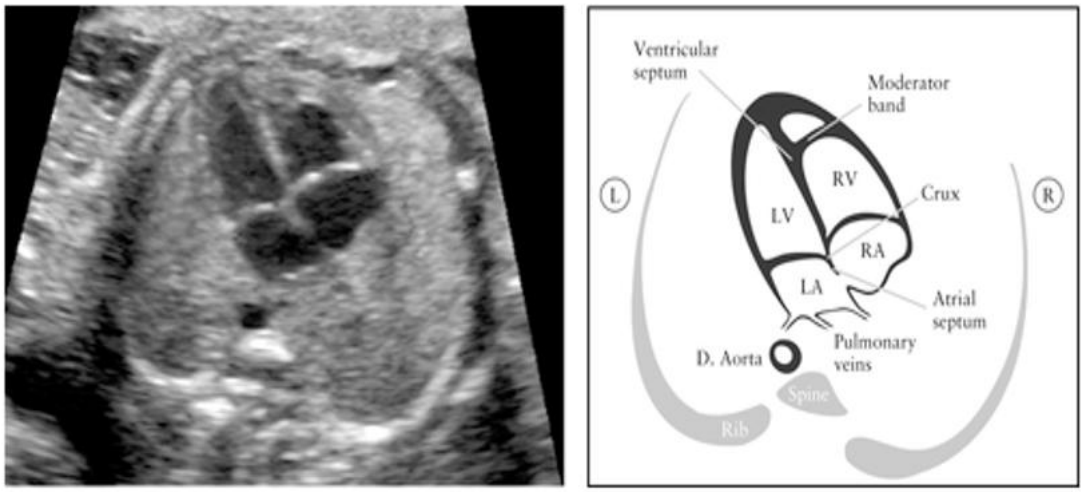
Congenital cardiac disease is seen in 2–6.5 of 1000 live births and is a major cause of morbidity and mortality, with half of these cases being lethal or requiring surgical correction. The main objective of the antenatal diagnosis of CHD is to reduce perinatal morbidity and mortality.The prenatal recognition of CHD has major impacts on the pregnancy and its outcome. Many previous studies justify prenatal ultrasound (US) screening of CHD in the general low-risk population is beneficial. The application of an extended basic US cardiac examination improves the detection of CHD, in particular the conotruncal anomalies.

Patients and methods

The study was carried out in the Department of Radiodiagnosis and Imaging at Tertiary Care Hospital Surat, the equipment used was Philips Affinity 50 USG, VOLUSON E8-BT19 by a curvilinear 3 – 5 MHz C9-4V probe. The study was carried out over a duration of 12 months (April 2020 to March 2021).
Number of Patients: 500.

Inclusion criteria:
ANC patients between 18-20 weeks of gestation referred from OBG OPD to Department of Radiology for routine antenatal anomaly scan in New Civil Hospital Surat over a period of one year.
Exclusion criteria:
Patient refusing to give consent for investigation
Patient refusing to give consent for participation in study
Patient more than 20 weeks of gestation and less than 18 weeks of gestation.
Multiple pregnancies.
Age of patients less than 18 years

THREE VESSEL TRACHEAL VIEW WITH ILLUSTRATED IMAGE



SONOGRAPHIC AND PICTORIAL IMAGES OF FOUR CHAMBERED HEART VIEW

II. Results:

Total number of mothers (gestational age in between18-20wks)examined is 500,foetuses with cardiac anomalies is 15 (3%).

CARDIAC ANOMALIES IDENTIFIED IN STUDY POPULATION

S.NO	4CV	3TV	SEEN IN BOTH THE VIEWS	DIAGNOSIS
1	+	+	+	TGA WITH VSD
2	+	+	+	TA WITH VSD
3	-	+	-	RIGHT SIDED AORTIC ARCH
4	+	+	+	TOF
5	-	+	-	TGA WITHOUT VSD
6	+	-	-	VSD
7	-	+	-	PLSVC
8	+	-	-	ASD
9	+	+	+	LT SIDED HYPOPLASTIC HEART
10	-	+	-	PULMONARY STENOSIS
11	+	-	-	VSD

12	+	+	+	DORV WITH VSD ASS WITH COARCTATION
13	+	-	-	ENDOCARDIAL CUSHION DEFECT
14	+	-	-	RHABDOMYOMA
15	+	-	-	VSD
TOTAL	6	4	5	
PERCENTAGE	40%	26.67%	33.34%	

The study depicts that all the 15 cases would have been identified if both theviews are taken accounting to the sensitivity of 60% of 3VTT alone and 73.3% of 4C alone and 100% sensitivity can only be attained on using both the views with proper diagnostic capability and practice.

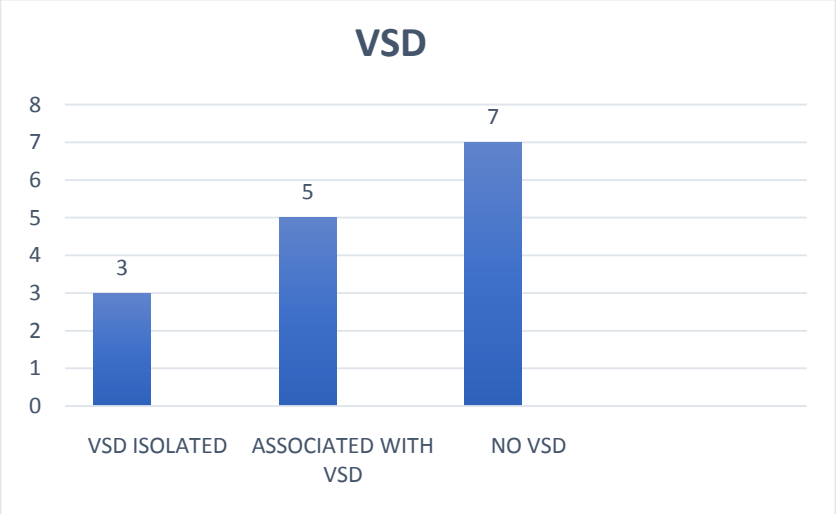
TABLE 2: ANOMALIES DETECTED ON VARIOUS VIEWS

DIAGNOSED BY	3VT ONLY	4C ONLY	BOTH
NUMBER	9	11	15
PERCENTAGE	60.0	73.33	100%

TYPES OF ANAMOLIES AND FREQUENCY

- In this study on broadly categorizing the identified anomalies VSD (n=8) turned out to be the having the highest frequency followed by TGA(n=3).

1	TGA	3
2	VSD	8
3	ASD	2
4	ECD	1
5	PTA	1
6	PLSVC	1
7	Left hypoplastic heart	1
8	Rhabdomyoma	1
9	PS	2
10	TOF	1



In total foetuses with cardiac anomalies VSD is the most common which include 53.33% (n=8) either isolated or associated with other anomalies.

Ventricular septal defect (VSD), Atrial septal defect (ASD), Transposition of great arteries (TGA), Patent truncus arteriosus (PTA), Persistent left sided SVC (PLSVC)

III. Discussion

Our study demonstrates that the 3VT view provides important clues to the diagnosis of most of the cardiac and outflow tract anomalies. Because the anatomy visualized is simple and time utilized is feasible, discrepancies in the vessel number or subtle distortions in vessel size or arrangement are readily discernible.Foetuses with complete transposition of the great arteries can be easily suspected by observing two rather than three vessels in the 3VT view. In cases of hypoplastic left heart syndrome and severe coarctation of the aorta, a significant discrepancy in size between both arterial vessels is observed. The diagnostic feature of coarctation of the aorta which has been shown is the presence of TAoA and isthmic hypoplasia.The visualization of a pulmonary trunk that is smaller than the TAoA in this section view provides a clue to the diagnosis of right outflow tract obstruction. Color flow mapping at this level allows easy recognition of reversed flow in one of the arterial vessels which gives idea of importance of maintaining ductal patency.

Yagel S according to it maximum of 10 minutes utilized for 3VT view according to this study approx. it takes 5-10 minutes on an average to acquire 3VT views.

According to study done by F Vinals classified the lesions according to the most evident abnormal finding during the examination. Gestational age ranged from 17 to 39 (mean, 30) weeks. Abnormal vessel size was found in 20 of the 74 foetuses, abnormal vessel alignment was found in two foetuses, and abnormal vessel arrangement in three foetuses. Two vessels instead of three were found in five foetuses and four vessels were found in two foetuses. Abnormal visualization of the trachea, between the pulmonary artery and the transverse arch, occurred in one foetus with isolated right aortic arch.

In this study, total foetuses with cardiac anomalies VSD is the most common which include 53.33% (n=8) either isolated or associated with other anomalies.According to Huang et al a nationwide database in Taiwan, the prevalence of CHD is 13.08 per 1000 live births. Moreover, in Taiwan, the most common subtype of CHD is VSD.

The 3VT view also provides clues for the diagnosis of minor but significant lesions of the upper mediastinum. The demonstration of the side of the aortic arch may be very difficult prenatally and remains one of the most problematic aspects of antenatal diagnosis of CHD. However, the relationship between the TAoA and the trachea facilitates determination of the side of the arch. As right aortic arch has been associated with congenital intracardiac anomalies, microdeletion of chromosome 22q11 and vascular ring 24, it must be carefully considered in prenatal counselling

In this study the diagnosis of right sided aortic arch was made out only by the evidences of relationship of trachea and the vessel which is relatively easy for diagnosing which have a relatively normal four chambered view. Four vessels rather than three have also been found in foetuses with interruption of the inferior vena cava and azygos continuation, another marker of CHD.

Our study, demonstrates that the 3VT view is a reliable method to determine abnormalities in the upper mediastinum.It proved to be efficient in identifying an important group of critical heart defects involving the outflow tracts and the aortic arch.

Stumpflen in their study have stated thatInclusion of detailed foetal echocardiography as a screening examination has a substantial effect on detection of congenital heart disease since a major proportion of prenatally detectable cases occur in a low-risk population

We believe that use of the 3VT view should become routine in screening for CHD as the outflow tract abnormalities make a great chunk of cardiac anomalies which are missed in routine four chambered heart view done for cardiac screening as per the observation in this study:

Out of all 15 mothers with anomalous foetuses 6 cases are identified on 4C view alone and 4 cases have positive findings on 3VT view alone and 5 cases have positive findings on both the views.

So only 11 out of 15 foetuses would have been identified if only 4chambered view is done alone with remaining 4 leaving 26.7% of the foetuses being undiagnosed which have a grave affect on both the mother and newborn.

All the 15 cases would have been identified if both the views are taken accounting to the sensitivity of 60% of 3VTT alone and 73.3% of 4C alone and 100% sensitivity can only be attained on using both the views with proper diagnostic capability and practice.

Full heart examination, which would be the ideal goal for every fetus, is beyond the capability of most sonographers and is realistically inapplicable in busy.

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