Results

Table (2): Clinical and laboratory findings of the studied children:

Parameter	Value
Total number of patients	30
Sex: Males Females	 16 14
Age in years (Mean ± SD)	3.6 ± 4.5
Cyanotic heart diseases	8 (26.6%)
Acyanotic heart diseases	22 (73.4%)
Clubbing	4 (13.3%)
Precordial bulge	7 (23.3%)
Repeated chest infection	23 (76.6%)
HB% (Mean ± SD)	11.11 ± 2.6
HCT% (Mean ± SD)	33.4 ± 7.9
$SpaO_2$ (Mean ± SD)	87.2 ± 10.9

Table (2) shows total number of the study patients, sex, mean age, number of cyanotic and acyanotic cases, some manifestations like clubbing, precordial bulge, repeated chest infections, mean of HB%, HCT and O2 saturation.

Table (3): Chest x-ray findings among the studied children:

Chest x-ray	No	%
Bronchovascular markings	22	73.4%
Lung plethora	18	60%
Lung oligemia	12	40%
Cardiomegaly	19	63.3%

Table (3) and figure (15) show number and percentage of different radiological findings of the chest (bronchovascular markings, plethora, oligemia and cardiomegaly) in the study children.

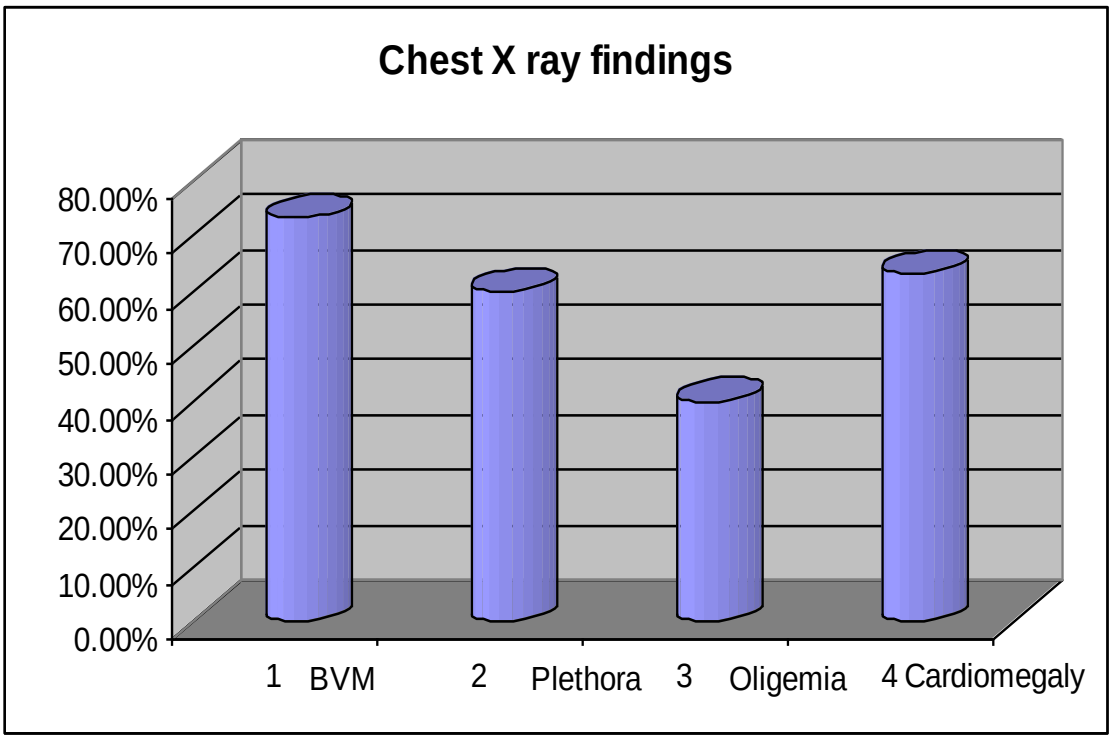

Fig.(15): Chest x-ray findings among the studied children.

Table (4): Measurement of intraocular pressure (IOP) among the studied children:

	No	%
↑IOP	8	26.4%

Table (4) and figure (16) shows that 26.4% of the studied children have increased intraocular pressure.

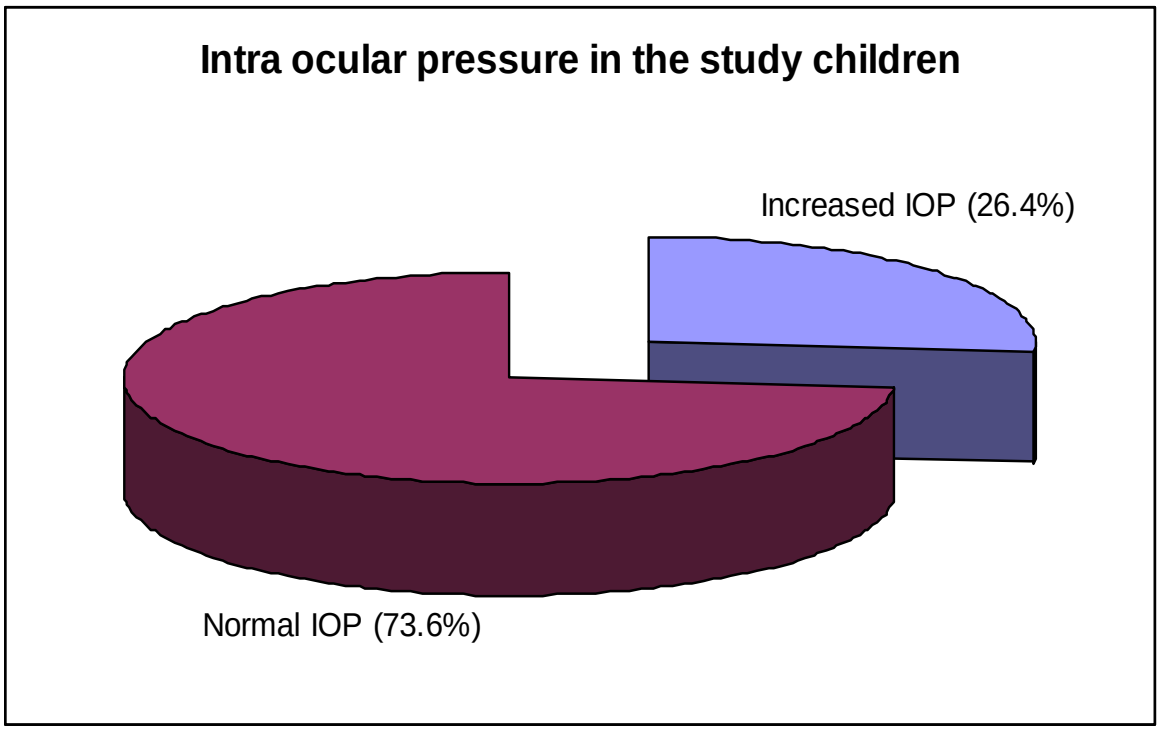

Fig.(16): Measurement of intraocular pressure (IOP) among the studied children.

Table (5):Fundus examination findings among the studied children:

Fundus finding	No	%
↑ Retinal vascular tortuosity (RVT)	12	40
Attenuated retinal vessels (ARV)	17	56.6
Straightened retinal vessels (SRV)	15	51.7
Retinal hemorrhage (Hge)	2	6.6
Papilledema	3	10%

Table (5) & figure (17) show the number and percentage of the retinal findings detected by fundus examination (increased retinal vacular tortuosity, attenuated retinal vessels, straightening of retinal vessels, retinal hemorrhage and papilledema) in the studied children.

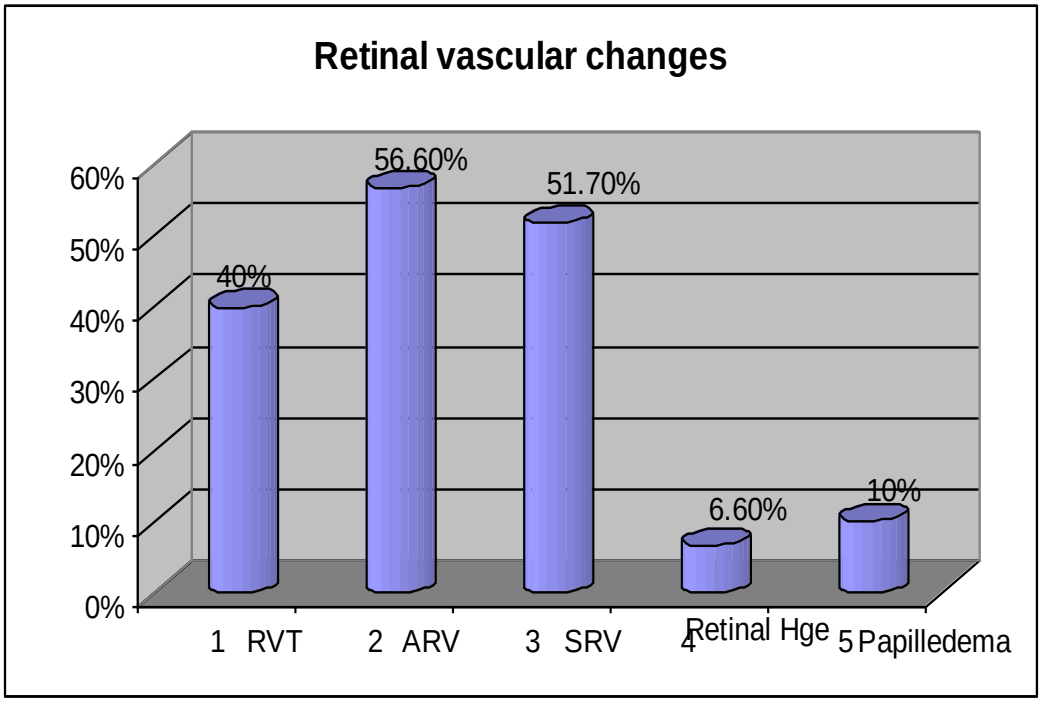

Fig.(17): Fundus examination findings among the studied children.

Table (6): Statistical distribution of the studied congenital heart diseases:

CHD	No	%
Aortic coarctation	2	6.6
ASD	4	13.3
ASD + mesocardia	1	3.3
ASD + PS	2	6.6
ASD + VSD	1	3.3
PDA	3	10
Severe PS	2	6.6
TGA	2	6.6
TOF	3	10
VSD	7	23.3
VSD + PH	2	6.6
VSD + PS	1	3.3

Table (6) & figure (18) show the percentage of different types of the studied congenital heart diseases including aortic coarctation, atrial septal defect, mesocardia, pulmonary stenosis, ventricular septal defect, patent ductus arteriosus, transposition of great arteries and tetralogy of Fallot.

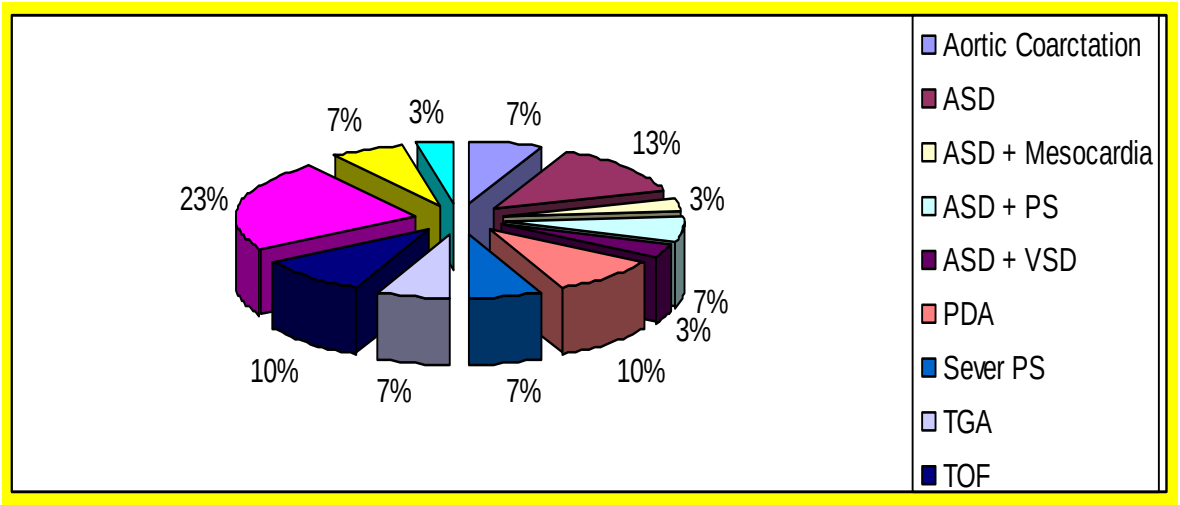

Fig.(18): Statistical distribution of the studied congenital heart diseases.

Table (7): Statistical correlation of arterial oxygen saturation ($SpaO_2$) and fundus examination findings among the studied children:

$SpaO_2$	(r)	p
↑ Intraocular pressure (IOP)	- 0.2567	> 0.05
↑ Retinal vascular tortuosity (RVT)	- 0.20519	> 0.05
Attenuated retinal vessels (ARV)	- 0.4533	< 0.05*
Straightened retinal vessels (SRV)	- 0.45276	< 0.05*
Retinal hemorrhage (Hge)	- 0.2288	> 0.05
Papilledema	- 0.27309	> 0.05

Table (7) shows the correlation between oxygen saturation and different retinal findings with positive significant correlation between decreased oxygen saturation and both retinal vascular attenuation and straightening.

Table (8): Statistical correlation of cyanosis and fundus examination findings among the studied children:

Cyanosis	(r)	p
↑ Intraocular pressure (IOP)	0.3068	< 0.05*
↑ Retinal vascular tortuosity (RVT)	0.3056	< 0.05*
Attenuated retinal vessels (ARV)	0.3158	< 0.05*
Straightened retinal vessels (SRV)	0.3214	< 0.05*
Retinal hemorrhage (Hge)	0.278	< 0.05*
Papilledema	0.3333	< 0.05*

Table (8) shows the correlation between cyanosis and different findings of fundus examination with positive significant correlation between cyanosis and all retinal changes in children with congenital heart disease.

Table (9): Statistical study of increased intraocular pressure (IOP) among the studied children:

↑IOP	Cyanotic		Acyanotic		Z	P
	No	%	No	%		
Yes	3	37.5	5	22.7	0.8	> 0.05
No	5	62.5	17	77.3		
Total	**8**	**100**	**22**	**100**		

Table (9) & figure (19) show no statistical significant difference between cyanotic and acyanotic children regarding increased intraocular pressure.

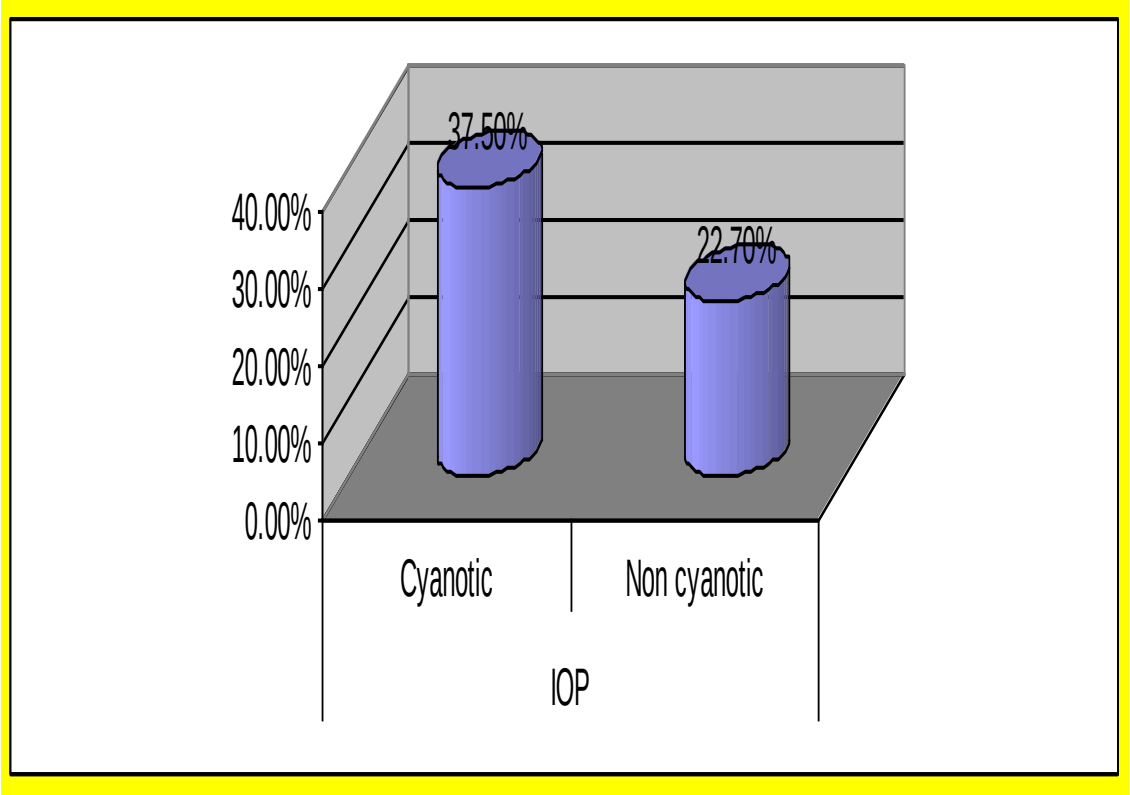

Fig.(19): Statistical study of increased intraocular pressure among the studied children.

Table (10): Study of retinal vascular tortuosity (RVT) among the studied children:

↑RVT	Cyanotic		Acyanotic		Z	P
	No	%	No	%		
Yes	4	50	8	36.3	0.6	> 0.05
No	4	50	14	63.6		
Total	**8**	**100%**	**22**	**100%**		

Table (10) & figure (20) show no statistical significant difference between cyanotic and acyanotic children regarding increased retinal vascular torsuosity.

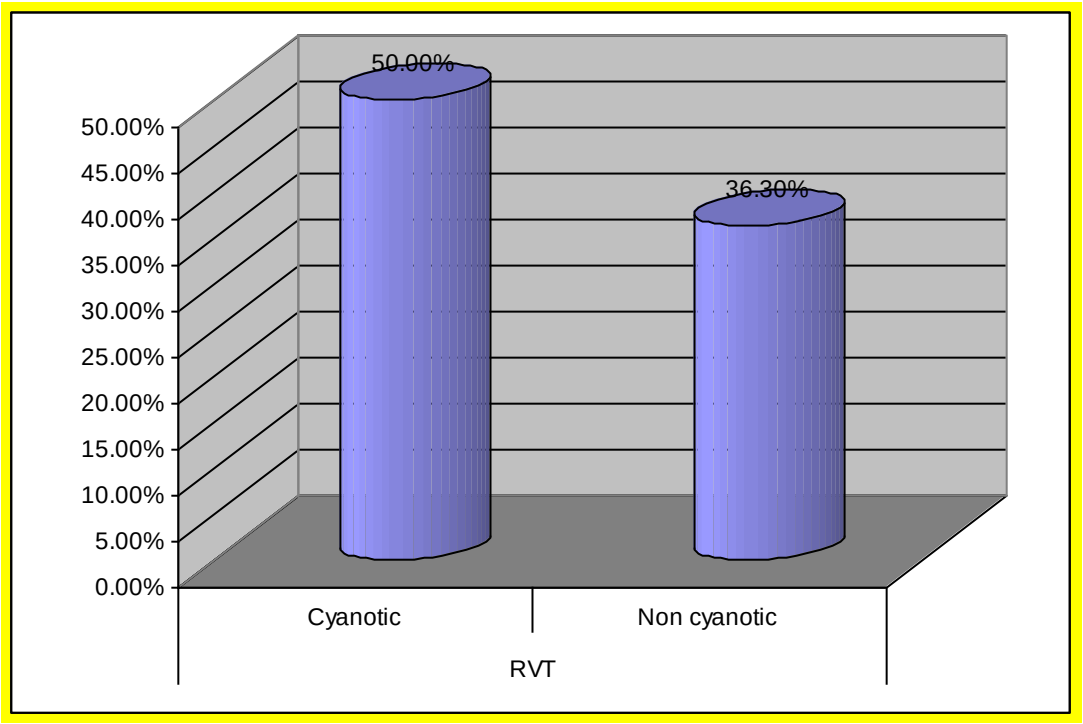

Fig.(20): Study of retinal vascular tortuosity among the studied children.

Table (11): Study of attenuated retinal vessels (ARV) among the studied children:

ARV	Cyanotic		Acyanotic		Z	P
	No	%	No	%		
Yes	7	87.5	10	45.4	2	< 0.05*
No	1	12.5	12	54.6		
Total	**8**	**100%**	**22**	**100%**		

Table (11) & figure (21) show the statistical difference between cyanotic and acyanotic children regarding attenuated retinal vessels. It was found in 87.5% of cyanotic versus 45.4% in acyanotic heart disease, showing positive significant increase in cyanotic cases. The attenuation of retinal vessels may be due to vascular injury by hypoxia leading to increased endothelial thickness through release of vascular endothelial growth factor (VEGF).

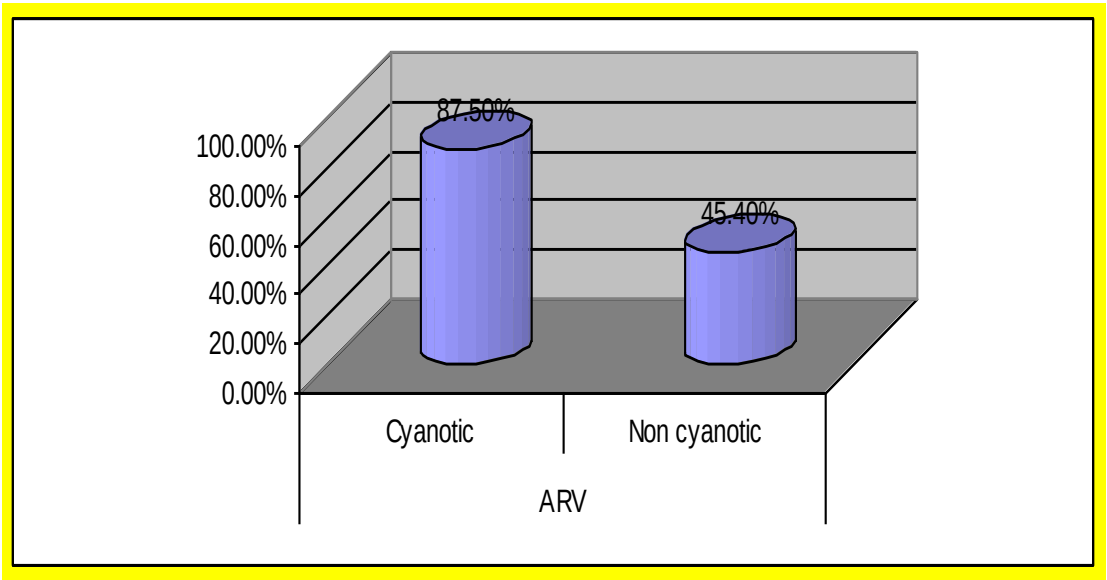

Fig.(21): Study of attenuated retinal vessels among the studied children.

Table (12): Study of retinal vescular straightening (SRV) among the studied children:

SRV	Cyanotic		Acyanotic		Z	P
	No	%	No	%		
Yes	2	25	14	63.6	1.8	> 0.05
No	6	75	8	36.3		
Total	**8**	**100%**	**22**	**100%**		

Table (12) & figure (22) show the statistical difference between cyanotic and acyanotic children regarding straightening of retinal vessels. It was found in 25% of cyanotic versus 63.6% in acyanotic heart disease showing no significant difference in both types of congenital heart disease. Straightening of retinal vessels in acyanotic heart disease may be due to haemodynamic changes and vacular endothelial injury by hyperdynamic circulation.

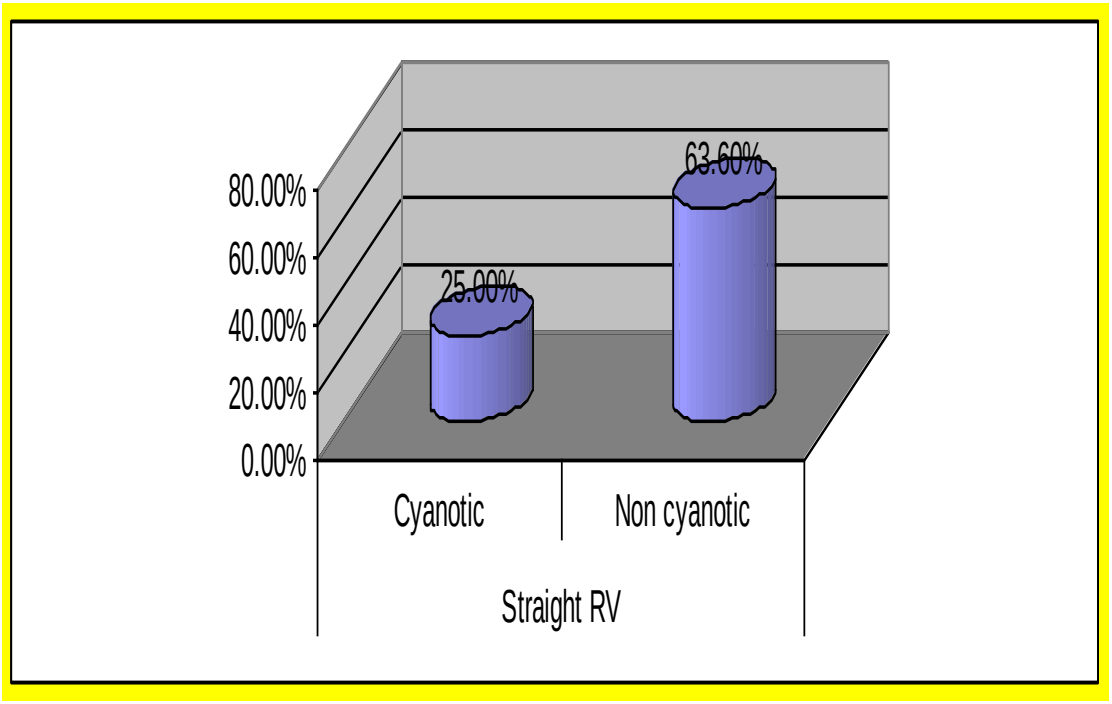

Fig.(22): Study of retinal vescular straightening among the studied children.

Table (13): Study of retinal hemorrhage among the studied children:

Retinal Hge	Cyanotic		Acynotic		Z	P
	No	%	No	%		
Yes	1	12.5	1	4	0.7	> 0.05
No	7	87.5	21	96		
Total	**8**	**100%**	**22**	**100%**		

Table (13) & figure (23) show the statistical difference between cyanotic and acyanotic children regarding retinal haemorrhage. It was found in 12.5% of cyanotic versus 4% in acyanotic heart disease showing no significant difference in both types of congenital heart disease. Retinal haemorrhage may be due to rupture of capillaries as a result of severe hypoxia and hemodynamic changes.

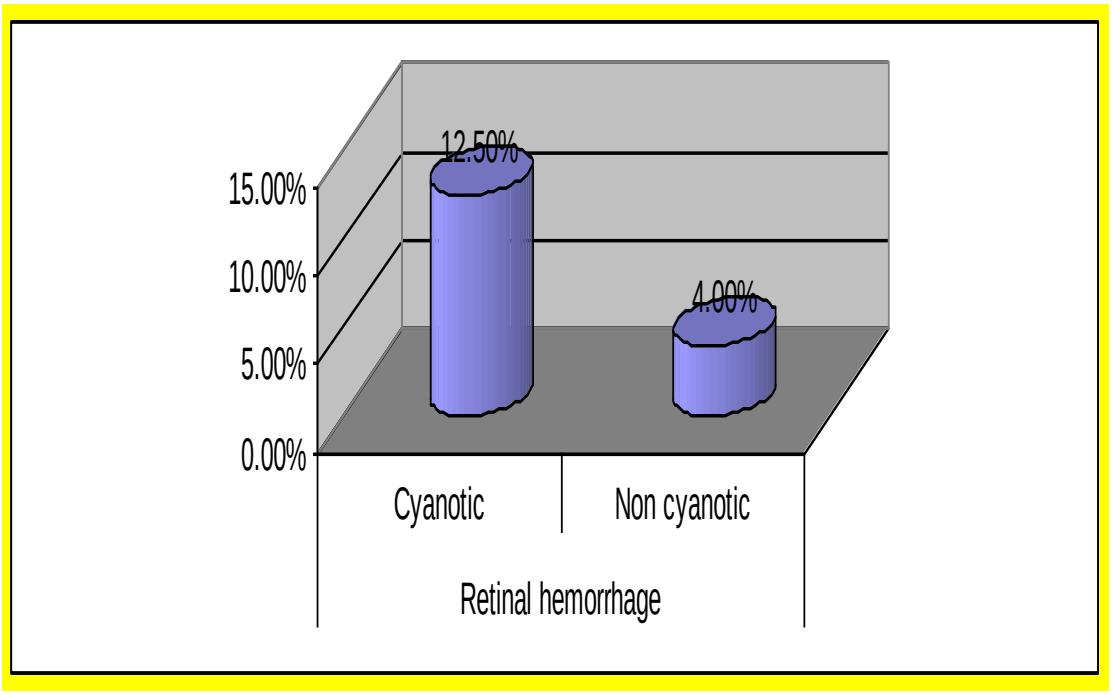

Fig.(23): Study of retinal hemorrhage among the studied children.

Table (14): Study of papilledema among the studied children:

Papilledema	Cyanotic		Acyanotic		Z	P
	No	%	No	%		
Yes	2	25	1	4.54	1.4	> 0.05
No	6	75	21	95.46		
Total	**8**	**100%**	**22**	**100%**		

Table (14) & figure (24) show the statistical difference between cyanotic and acyanotic children regarding papilledema. It was found in 37.5% of cyanotic versus 13.6% in acyanotic heart disease showing no significant difference in both types of congenital heart disease. Papilledema may be due to oozing of capillary fluid through injured capillary wall as a result of severe hypoxia and hemodynamic changes.

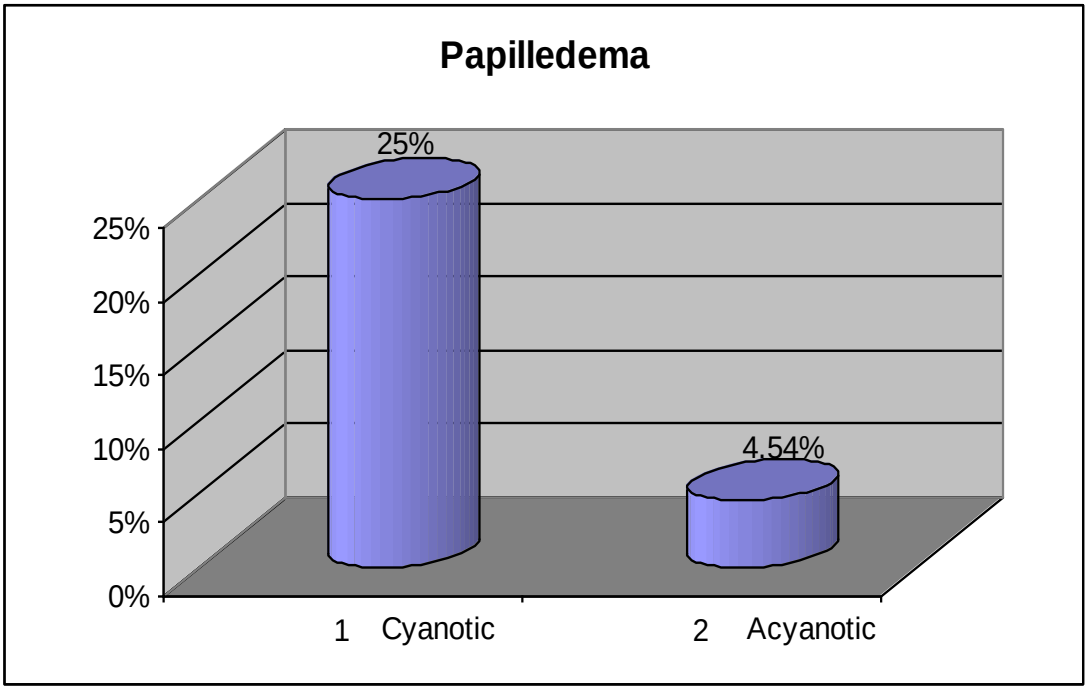

Fig.(24): Study of papilledema among the studied children.

Table (15): Statistical study of haemoglobin level, hematocrite value and arterial oxygen saturation among the studied children:

Variable	Cyanotic (n = 8) Mean± SD	Acynotic (n = 22) Mean± SD	t	P
Hemoglobin level (HB%)	13.4 ± 3.3	10.2 ± 1.7	1.4	< 0.01**
Hematocrite value (HCT)	40.37 ± 9.9	30.9 ± 5.3	3.3	< 0.01**
Arterial oxygen saturation ($SpaO_2$)	60.37 ± 9.9	90.9 ± 5.3	3.3	< 0.01**

Table (15) & figure (25-27) show the statistical difference between cyanotic and acyanotic children regarding haemoglobin level, hematocrite value and arterial oxygen saturation with highly positive significant difference in both types of congenital heart disease.

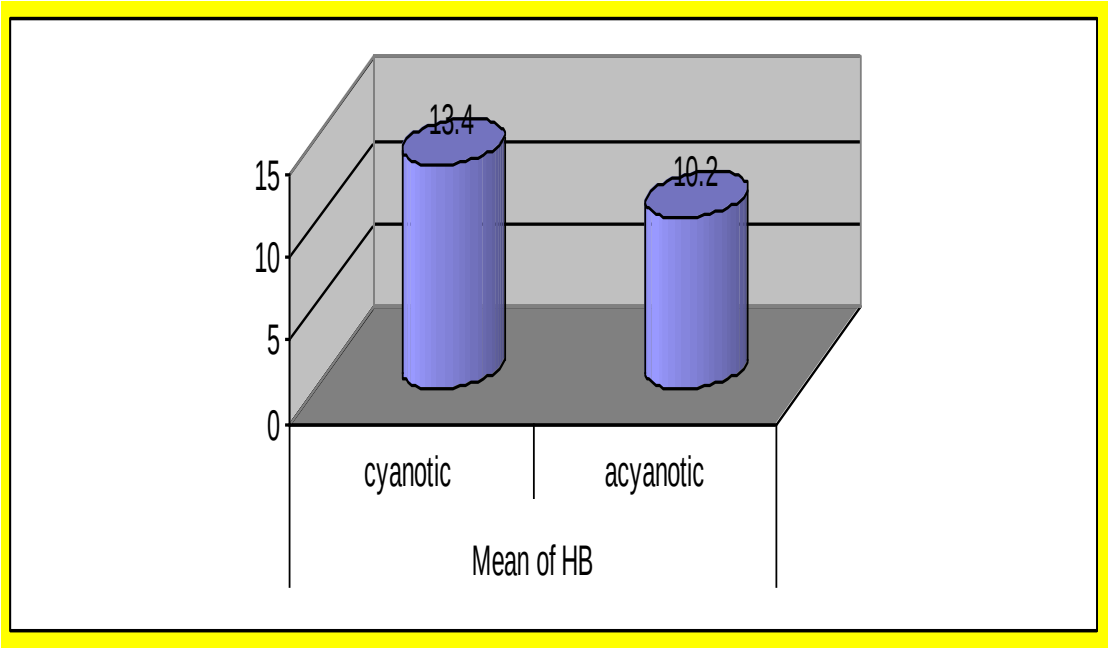

Fig.(25): Statistical study of haemoglobin level among the studied children.

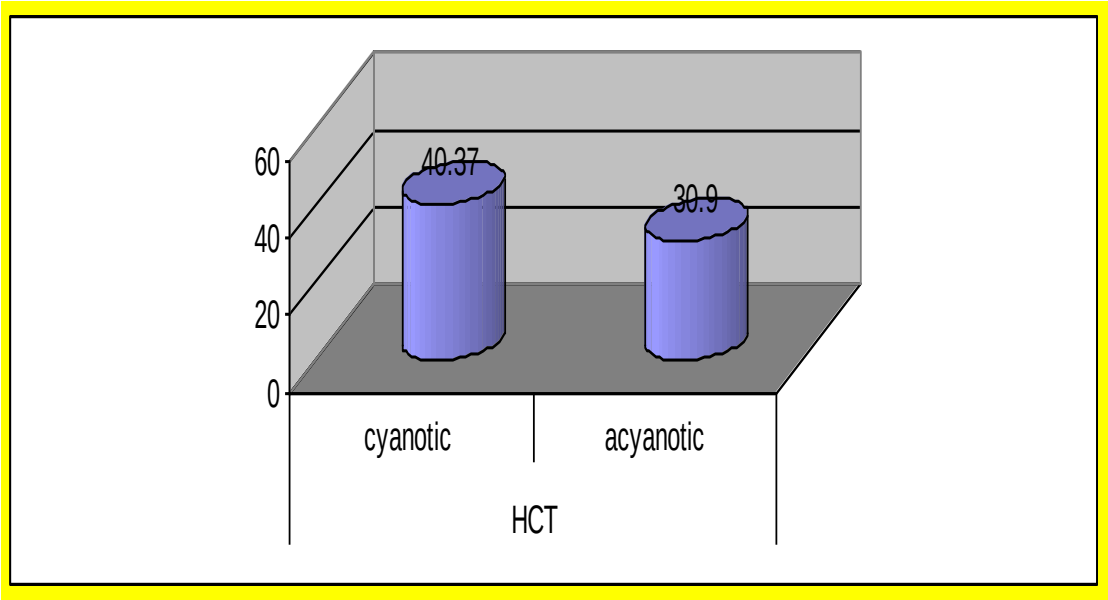

Fig.(26): Statistical study of hematocrite value among the studied children.

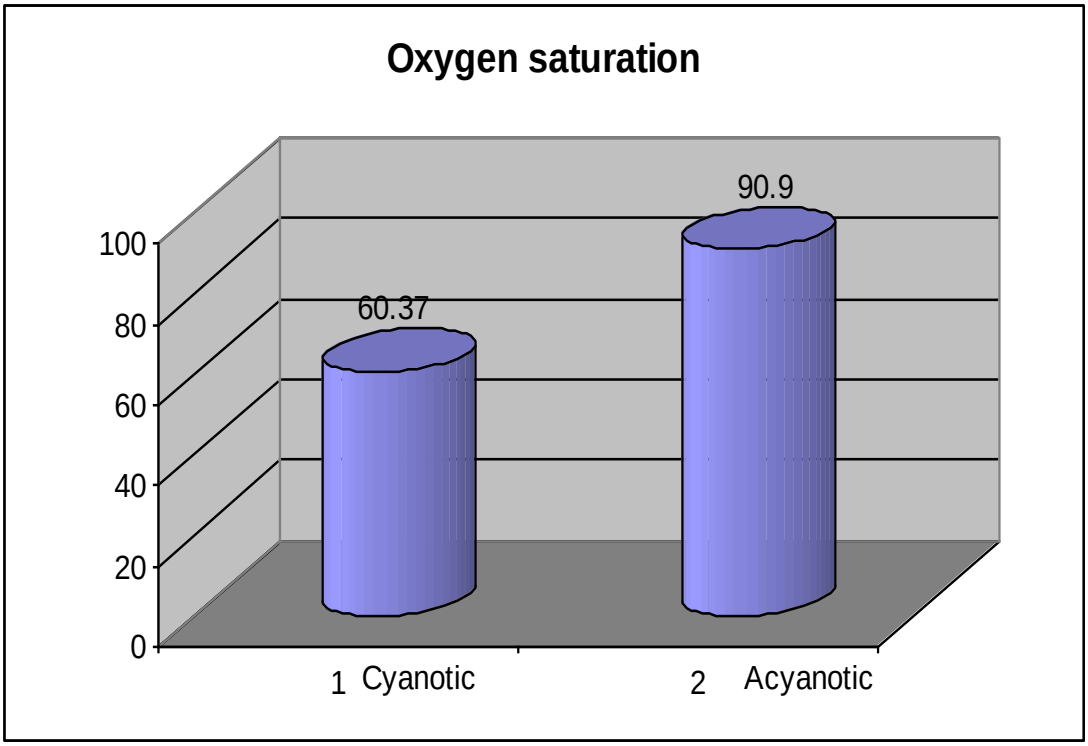

Fig.(27): Statistical study of arterial oxygen saturation among the studied children.