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Risk Factors and Early Outcomes of Arrhythmia Following Congenital Cardiac Surgery in Pediatrics

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Abstract: Arrhythmias after pediatric cardiac surgery are common and can be life threatening. They occur intraoperatively or may appear shortly after surgery during postoperative care. They require early management and specific intervention. Postoperative arrhythmias were a major cause of mortality and morbidity after cardiac surgery for congenital heart disease. In the early postoperative period after cardiac surgery, patients with congenital heart disease are especially vulnerable to rhythm disturbances. The aim of this study was to analyze the possible causes and risk factors of early arrhythmia to determine the outcome of patients and prevention of arrhythmia after congenital cardiac surgery in pediatrics. This prospective cohort study was carried on 24 patients who underwent cardiac operation with or without cardiopulmonary bypass (CPB) in pediatric cardiothoracic intensive care unit (ICU) and pediatric cardiology unit of Zagazig university hospitals. the mean age of patients was 4.39 years , mean body weight was 18.31kg, mean height was 96.29 cm, Regarding sex 54% were female and 45% were male. operative data in our study, the mean total time of operation was 1.38 hour, mean CPB time was 48.64 min, mean ischemic time was 29 min. In our study incidence of early postoperative arrhythmias was 17.6% which is considered near to a previously reported studies. In echocardiographic finding arrhythmias significantly associated with increasing mean PASP ($p=0.02$) and decrease of EF% ($p<0.001$) which agreed with previous studies. We found Fragmented QRS complex is an important noninvasive tool that help in early detection of occurrence of postoperative arrhythmias.

Keywords: Postoperative arrhythmias, Cardiac surgery, Pediatrics

Introduction

Cardiac arrhythmia is a group of condition in which the heartbeat is too fast or too slowly or with an irregular rhythm. These arrhythmias occur mostly in the early postoperative period when hemodynamic fluctuations are common, making the patient unstable and may lead to low cardiac output syndrome (LCOS) and cardiac arrest unless treated and resolved in a timely fashion [1].

Arrhythmias are well-known complications after congenital cardiac surgery. Although transient and treatable in most cases, they are a cause of substantial morbidity and mortality. These arrhythmias occur mostly in the early postoperative period when hemodynamic fluctuations are common, making the patient unstable and may lead to low cardiac output syndrome (LCOS) and cardiac arrest unless treated and resolved in a timely fashion. Review of existing literature revealed an incidence of arrhythmias ranging from 7.3% to 48%1, in the early postoperative period after congenital cardiac surgery [2]**.**

The etiology of postoperative arrhythmias in children who are recovering from the effects of surgery may include myocardial incision, cannulation, sutures close to the conduction system, cardiac dysfunction, electrolyte disturbances, catecholamine stimulation, acute changes in intracardiac pressures and volumes, cardiopulmonary bypass (CPB)-related inflammation, ischemia–reperfusion, residual hemodynamic impairment, as well as pain and anxiety [2]**.**

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Postoperative arrhythmias were a major cause of mortality and morbidity after cardiac surgery for congenital heart disease.1 In the early postoperative period after cardiac surgery, patients with congenital heart disease are especially vulnerable to rhythm disturbances. There have been numerous reports published about arrhythmia as a late complication of surgical procedures, such as the Mustard or Senning operation for transposition of the great arteries, Fontan procedures, or tetralogy of Fallot repair [3]**.**

Aim of the work: The aim of this study was to analyze the possible causes and risk factors of early arrhythmia to determine the outcome of patients and prevention of arrhythmia after congenital cardiac surgery in pediatrics.

Patients And Methods

This Prospective observational study was carried out in pediatric cardiothoracic intensive care unit (ICU) and pediatric cardiology unit of Zagazig university hospitals on 24 patients <18-years of both sexes with congenital heart disease who underwent cardiac operation with or without cardiopulmonary bypass (CPB) during the period from January to July 2020.

Written informed consent was obtained from all children' parents, the study was approved by the research ethical committee of Faculty of Medicine, Zagazig University. The study was done according to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

All patients included in the study were intensively monitored in the early postoperative period (72 h) for the detection of any rhythm abnormality and followed until they were discharged from hospital.

For each case, we collected demographic data and recorded the cardiac diagnosis, perioperative parameters, operational procedures and postoperative parameters. For this study, an arrhythmia was defined as an alteration in the heart rate or rhythm that necessitated an intervention, such as a change in medication, use of temporary pacing wires, or electrical cardioversion/ defibrillation

All patients in this study were subjected to*:*

General examination: A general physical examination was performed with special attention to findings suggestive of CHD, including cyanosis, pallor, clubbing, coarse features, edema**,** hepatomegaly**,** extra cardiac malformations, vital signs including (temperature, heart rate, respiratory rate)**,** diminished or absent lower extremity pulses, and blood pressure.

Anthropometric Measurements: Anthropometric measurements included weight (kilogram), length (centimeter), body mass index. Weight and length were performed according to standard WHO procedures. Z scores for weight for age (WAZ), length/height for age (HAZ)**.**

Systemic examination: **I. Cardiac examination** for abnormal precordial activity, shape, abnormal heart sounds (e.g: third heart sound [S3] gallop, click, or single second heart sound [S2]), pathologic murmurs with its characters and chamber enlargement. **II. Chest examination** for increase work of breath, crepitations.

Routine Laboratory investigations including**:** CBC, CRP, Kidney function tests, Liver function tests, electrolytes, thyroid function test.

Specific investigations for diagnosis of CHD:

Plain chest x-ray: Postero-anterior view for detection of cardiomegaly, pulmonary vasculature, and other cardiopulmonary diseases.

ECG: To detect arrhythmia and chamber enlargement.

Echocardiography: All patients underwent echocardiographic examination befor and after surgery.

Operative data:

1-Type of surgery

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2- Total duration of surgery

3-Cardiopulmonary bypass time

4-Ischemic time

When necessary, the following inotropic drugs were used: Milrinone (0.3-0.75mcg\kg\min), Adrenaline (0.1- 0.5 mcg \kg\min), Dobutamine (5-20 mcg\kg\min), while weaning them from CPB. Post-operative stay in the intensive care unit (ICU stay) was also recorded.

Postoperative data:

General examination: Heart rate – respiratory rate – Blood pressure – Body temperature continuous monitor -Pallor –Cyanosis – Jaundice.

Systemic examination:CVS: Auscultation: S1 + S2 + murmur, Chest examination

Investigation:

(CBC , Serum Electrolytes: (Na - K – Ca), Blood sugar , Kidney function test, liver function test, ABG)

Electrodiogram (ECG): arrhythmias (types)

Standard electrocardiogram (ECG) was registered in all patients at time of ICU admission, using areal time electrocardiograph with 3 channel recorders.

Continuous ECG monitoring was performed during the entire ICU stay with monitors.

Any sustained rhythm abnormality (those lasting for ≥30 s duration, recurrent and/or causing hemodynamic disturbance) detected on the ECG monitor was assessed by standard 12-lead electrocardiogram (ECG).

THE presence of Fragmented QRS complex (FQRS) also was assessed by ECG were Its defined as as the presence of R' or notching of R or S waves in both narrow and wide QRS complex on at least two contiguous leads of those representing anterior (V_1–V_5), lateral (I, aVL, V_6), or inferior (II, III, aVF) myocardial segments. and its important predictor of arrhythmias

Before hospital discharge, a 12-lead ECG will be routinely done.

Echocardiography for assessment of Aorta (AO), left atrium (LA) mm , left ventricle end systolic diameter (LvESD) mm, left ventricular end diastolic diameter (LvEDD) mm, Ejection Fraction EF%, fractional Shortening FS % and Pulmonary arterial pressure (PASP) mmHG.

Statistical analysis

Data entry, processing and statisticsl analysis was carried out using Statistical Package for the Social Sciences (SPSS version 20.0) software for analysis. Qualitative data were described using number and percent. The Kolmogorov-Smirnov test was used to verify the normality of distribution. Quantitative data were described using range (minimum and maximum), mean, standard deviation, median and interquartile range (IQR). The following statistical tests and parameters were used: 1- Paired t-test: For normally distributed quantitative variables, to compare between two periods. 2- Wilcoxon signed ranks test: For abnormally distributed quantitative variables, to compare between two periods Significance of the obtained results was judged at the 5% level (0.05). P > 0.05: Non significant., P < 0.05: Significant and P < 0.005: Highly Significant

Table (1): General & cardiac examination among the studied group pre & postoperative

Variable		Pre (n=24)	Post (n=24)	Paired t	P
HR (beat/min)	Mean ± SD Range	133.13 ±12.83 110 - 165	148.96 ±26.15 118 – 210	**3.95**	**0.001 ****
RR (breath/min)	Mean ± SD Range	34.83 ± 3.80 28 - 40	37.96 ± 4.33 30 – 47	**3.04**	**0.006 ****

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Temperature (^{0})	Mean ± SD Range	37.30 ± 0.49 36.2 – 38.2		37.87 ± 0.46 37 – 39		**3.80**	**0.001 ****
SBP (mmHg)	Mean ± SD Range	110.79 ± 15.7 60 - 140		113.63± 17.26 90 – 140		0.56	0.58 NS
DBP (mmHg)	Mean ± SD Range	64.29 ± 10.78 40 - 87		62.58 ± 7.17 50 – 80		0.66	0.52 NS
Variable		**No**	**%**	**No**	**%**	**Mc**	**P**
Pallor	No Yes	23 1	95.8 4.2	12 12	50 50	**4.23**	**0.001 ****
Cyanosis	No Yes	21 3	87.5 12.5	23 1	95.8 4.2	0.53	0.50 NS
Auscultation	S1+S2+machinery murmur S1+S2+ejection syst. murmur S1+S2+mild systolic murmur S1+S2+pan systolic murmur S1+S2 S1+S2+tachycardia	10 2 1 11 0 0	41.7 8.3 4.2 45.8 0 0	0 0 0 0 15 9	0 0 0 0 62.5 37.5	**10.87**	**<0.001 ****

Sd: Standard deviation t: paired t test Mc: McNemar test. NS: Non significant (P>0.05)**: highly significant (P<0.01) HR: Heart rate, RR: respiratory rate, SBO :Systolic blood pressure, DBP: Diastolic blood pressure.

This table shows that there was a statistical significance increase mean HR, RR, temperature and in frequency of pallor and tachycardia among the studied group postoperative compared to preoperative.

Table (2): Laboratory findings among the studied group pre & postoperative

Variable			**Pre (n=24)**	**Post (n=24)**	**Test**	**P**
CBC	**WBCs (x10^3/mm^3)**	Mean± SD Range	11.08 ± 1.12 8.2 – 13	13.6 ± 1.77 11.8 – 19	**T 6.33**	**<0.001****
	(RBCs) (x10^6/mm^3)	Mean± SD Range	4.33 ± 0.46 3.7 – 5.2	4.10 ± 0.38 3.5 – 5	T 1.84	0.08 NS
	Hb (gm/dl)	Mean ± SD Range	11.21 ± 0.99 9.5 – 13	10.58 ± 0.86 9 – 12	**T 2.65**	**0.01***
	HCT (%)	Mean ± SD Range	33.33 ± 4.09 21.3 – 37.9	33.63 ± 2.49 29.7 – 39.2	T 0.29	0.77 NS
Electrolyte	**Na**	Mean ± SD Range	139.84 ± 2.58 134 – 145	144.31± 7.64 130 – 165	**T 2.76**	**0.01***
	K	Mean ± SD Range	4.08 ± 0.61 3.4 – 6.5	4.17 ± 0.58 3.41 – 5.4	T 0.55	0.59 NS
	Ca	Mean ± SD Range	10.24 ± 0.78 9 – 11.5	9.83 ± 0.75 8.12 – 11	T 1.86	0.08 NS
	Mg	Mean ± SD Range	1.89 ± 0.24 1 – 2.17	2.18 ± 0.63 1.7 – 3.99	**T 2.07**	**0.05***
Other	**CRP (mg/dl)**	Mean ± SD Median (Range)	10.47 ± 15.94 7 (5 - 85)	21.39 ± 23.11 13 (4 – 82.7)	**W 3.81**	**<0.001****
	RBS (mg/dl)	Mean ± SD Range	102.92 ± 13.95 75 – 130	109.08 ± 22.47 60 – 140	T 1.53	0.14 NS
	Bun	Mean ± SD Median (Range)	10.67 ± 2.54 10 (7 – 18)	15.53 ± 10.21 13.35 (5 – 50)	**W 2.95**	**0.003****

Sd: Standard deviation, t: paired t test, W: Paired Wilcoxon test, NS: Non significant (P>0.05), *: Significant (P<0.05), **: highly significant (P<0.01) WBC: White blood cell count, RBC: Red blood cell Hb: Hemoglobin, HCT: Hematocrit Na: Sodium, K: potassium, Ca: Calcium, Mg: Magnesium, CRP: Creative protein, RBS: Random blood sugar.

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This table shows that there was a statistically significance increase mean WBCs, Na, Mg, CRP & Bun and decrease in mean Hb among the studied group postoperative compared to preoperative.

Table (3): ECG among the studied group pre & postoperative:

Variable		Pre (n=24)		Post (n=24)		Test	P
P amplitude (mv)	Mean ± SD Median (Range)	0.12 ± 0.06 0.11 (0.05-0.28)		0.11 ± 0.04 0.1(0.05-0.19)		W 1.17	0.09 NS
P duration (sec)	Mean ± SD Range	0.10 ± 0.03 0.06 – 0.16		0.10 ± 0.03 0.06 – 0.19		T 0.58	0.57 NS
PR interval (sec)	Mean ± SD Median (Range)	0.14 ± 0.0 0.12(0.08-0.3)		0.15 ± 0.06 0.14(0.09-0.3)		**W 2.16**	**0.03***
QRS duration (sec)	Mean ± SD Median (Range)	0.15 ± 0.08 0.11(0.05-0.3)		0.13 ± 0.04 0.12(0.05–0.2)		W 1.51	0.13 NS
Variable		**No**	**%**	**No**	**%**	**Mc**	**P**
ST segment	Iso-electrical	24	100	24	100	--	---
T wave	Normal Depressed Peaked	20 2 2	83.3 8.3 8.3	22 2 0	91.7 8.3 0	1.12	0.50 NS

Sd: Standard deviation t: paired t test, W: Paired Wilcoxon Mc: McNemar test, NS: Non significant (P>0.05), *: Significant (P<0.05)

This table shows that there was a statistically significance increase in mean PR interval among the studied group postoperative comparing to preoperative.

Table (4): ECHO among the studied group pre & postoperative

Variable		Pre (n=24)	Post (n=24)	Test	P
AO (mm)	Mean ± SD Range	18.08 ± 4.10 14 – 29	21.26 ± 5.12 14 – 35	**T 2.41**	**0.03***
LA (mm)	Mean ± SD Range	23.21 ± 3.41 17 - 30	24.61 ± 6.45 18 – 44	T 0.83	0.42 NS
LvEDD (mm)	Mean ± SD Range	32.33 ± 6.55 19 - 42	33.83 ± 7.81 27 – 54	T 0.55	0.59 NS
LvESD (mm)	Mean ± SD Range	21.42 ± 3.65 12 - 28	24.87 ± 7.39 18 – 44	**T 2.39**	**0.03***
EF (%)	Mean ± SD Range	62.96 ± 7.36 40 - 70	62.17 ± 6.87 48 – 75	T 0.62	0.54 NS
FS (%)	Mean ± SD Range	39.75 ± 4.86 30 - 55	33.09 ± 3.87 28 – 43	**T 6.00**	**<0.001****
PASP (mmHg)	Mean ± SD Median (Range)	31.21 ±12.92 30 (11 – 76)	23.65 ± 6.80 23 (12 – 39)	**W 2.95**	**0.003****

Sd: Standard deviation, t: paired t test, W: Paired Wilcoxon, Mc: McNemar test, NS: Non significant (P>0.05), *: Significant (P<0.05), **: highly significant (P<0.01), AO: aorta, LA: left atrium, LvEDD: left ventricle end diastolic diameter, LvESD: left ventricle end systolic diameter, EF: ejection fraction, FS: fractional shortening, PASP: pulmonary artery pressure.

This table shows that there was a statistically significance increase mean Ao, LvESD and decrease in mean PASP & FS postoperative compared to preoperative.

Table (5): Diagnosis among the studied group according to type of arrhythmia

Variable	All patient (n=24)		No arrhythmia (n=20)		SVT Arrhythmia (n=1)		JET Arrhythmia (n=3)	
	No	**%**	**No**	**%**	**No**	**%**	**No**	**%**

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Diagnosis	ASD	3	12.5	2	10	0	0	1	33.3
	VSD	9	37.5	8	40	0	0	1	33.3
	TOF	1	4.2	0	0	0	0	1	33.3
	PDA	8	33.3	8	40	0	0	0	0
	PDA+VSD	1	4.2	0	0	1	100	0	0
	PDA+ Pulmonary HPT	1	4.2	1	5	0	0	0	0
	PDA+TR	1	4.2	1	5	0	0	0	0

This table shows that the case had SVT arrhythmia s were diagnosed as PDA & VSD while among the 3 cases had JET arrhythmia one had ASD one had VSD & one had TOF.

Table (6): Relation between arrhythmia and laboratory findings among the studied group preoperative:

Variable			**No arrhythmia (n=20)**	**Arrhythmia (n=4)**	**Test**	**P**
CBC	**WBCs ($x10^3/mm^3$)**	Mean± SD Range	10.94 ± 1.16 8.2 - 13	11.8 ± 0.57 11.2 – 12.5	T 1.43	0.17 NS
	RBCs ($x10^6/mm^3$)	Mean± SD Range	4.38 ± 0.49 3.7 – 5.2	4.05 ± 0.17 3.8 – 4.2	T 1.32	0.20 NS
	Hb (gm/dl)	Mean± SD Range	11.25 ± 0.97 9.7 - 13	11.03 ± 1.23 9.5 – 12.5	T 0.41	0.69 NS
	HCT (%)	Mean± SD Range	33.62 ± 4.37 21.3 – 37.9	31.9 ± 2.05 29.2 – 33.9	T 0.76	0.46 NS
Electrolyte	**Na**	Mean± SD Range	139.9 ± 2.57 134 - 145	139.53±3.03 136 – 142.1	T 0.26	0.80 NS
	K	Mean± SD Range	3.96 ± 0.34 3.4 – 4.5	4.65 ± 1.24 3.9 – 6.5	**T 2.26**	**0.03***
	Ca	Mean± SD Range	10.41 ± 0.73 9 – 11.5	9.38 ± 0.43 9 – 10	**T 2.72**	**0.01***
	Mg	Mean± SD Range	1.89 ± 0.24 1 – 2.1	1.89 ± 0.28 1.5 – 2.17	T 0.03	0.98 NS
Other	**CRP (mg/dl)**	Mean± SD Median(Range)	7.27 ± 1.50 7(5 – 12)	26.5 ± 39.1 7.5 (6 - 85)	**MW 2.04**	**0.04***
	RBS (mg/dl	Mean ± SD Range	102.2±13.64 75 - 122	106.5±17.14 90 - 130	T 0.55	0.58 NS
	Bun	Mean ±SD Range	10.35 ± 2.15 7 – 15	12.28 ± 4 9.1 - 18	T 1.41	0.17 NS

Sd: Standard deviation t: Independent t test MW: Mann Whitney test, NS: Non significant (P>0.05) *: Significant (P<0.05) **: highly significant, (P<0.01). WBC: White blood cell count, RBC: Red blood cell Hb: Heamoglobine, HCT: Hematocrit Na: Sodium, K: potasium, Ca: Calecium, Mg: Magnesium, CRP: C reactive protien, RBS: Random blood sugar.

This table shows that there was a statistical significance increase in mean K & CRP and decrease in mean Ca among cases had arrhythmia compared to cases hadn't.

Table (7): Relation between arrhythmia & ECG among the studied group preoperative

Variable		**No arrhythmia (n=20)**	**Arrhythmia (n=4)**	**Test**	**P**
P amplitude (mv)	Mean ± SD Median(Range)	0.12 ± 0.05 0.11 (0.05-0.28)	0.15 ± 0.10 0.14(0.05-0.28)	MW 0.47	0.64 NS
P duration (sec)	Mean ± SD Range	0.09 ± 0.03 0.06 – 0.16	0.11 ± 0.03 0.08 – 0.16	T 1.19	0.25 NS
PR interval (sec)	Mean ± SD Median(Range)	0.14 ± 0.05 0.12(0.08-0.3)	0.15 ± 0.09 0.14(0.08-0.3)	MW 0.16	0.88 NS
QRS duration (sec)	Mean ± SD Median(Range)	0.15 ± 0.09 0.10(0.05-0.3)	0.16 ± 0.07 0.15(0.10–0.25)	MW 0.70	0.48 NS

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Variable		No	%	No	%	χ^2	P
T wave	Normal Depressed Peaked	18 1 1	90 50 50	2 1 1	10 50 50	3.84	0.15 NS
FQRS	-ve + ve (2 fragments)	20 0	95.8 0	1 3	4.8 100	17.1	>0.001

Sd: Standard deviation, t: Independent t test, MW: Mann Whitney, χ^2 : Chi square test, NS: Non significant (P>0.05).

This table shows that there was no statistical relation between arrhythmia and ECG findings among the studied group preoperative

Table (8): Relation between arrhythmia and ECHO measurements among the studied group preoperative

Variable		No arrhythmia (n=20)	Arrhythmia (n=4)	Test	P
AO (mm)	Mean ± SD Range	17.95 ± 3.89 14 - 29	18.75 ± 5.68 23.9 - 28	T 0.35	0.73 NS
LA (mm)	Mean ± SD Range	23 ± 3.29 17 - 28	24.25 ± 4.35 20 - 30	T 0.66	0.52 NS
LvEDD (mm)	Mean ± SD Range	33.1 ± 5.74 21 - 42	28.5 ± 9.85 19 - 37	T 1.30	0.21 NS
LvESD (mm)	Mean ± SD Range	21.75 ± 3.19 15 - 28	19.75 ± 5.74 12 - 25	T 1.00	0.33 NS
EF (%)	Mean ± SD Range	65.55 ± 2.26 60 - 70	50 ± 10.68 40 - 65	**T 6.36**	**<0.001****
FS (%)	Mean ± SD Range	39.15 ± 3.77 30 - 49	42.75 ± 8.73 36 - 55	T 1.38	0.18 NS
PASP (mmHg)	Mean ± SD Median (Range)	28.15 ± 8.70 29 (11 – 45)	46.5 ± 20.63 40 (30 – 76)	**MW 2.27**	**0.02***

Sd: Standard deviation t: Independent t test MW: Mann Whitney test χ^2 : Chi square test NS: Non significant (P>0.05) *: Significant (P<0.05) **: highly significant (P<0.01) , AO:aorta , LA: left atrium, LvEDD: left ventricle end diastolic diameter, LvESD: left ventricle end systolic diameter , EF: ejection fraction, FS: fractional shortening , PASP: pulmonary artery pressure

This table shows that there was a statistically significance increase in mean PASP and decrease in mean EF among cases had arrhythmia compared to cases hadn't.

Table (9): Relation between FQRS and ECHO among the studied group postoperative

Variable		=-ve (n=19)	+ve (n=5)	Test	P
AO (mm)	Mean ± SD Range	21.06 ± 5.17 14 – 35	22 ± 5.43 14 - 27	t 0.36	0.72 NS
LA (mm)	Mean ± SD Median (Range)	24.06 ± 5.37 23 (18 – 44)	26.6 ± 9.99 24 (20 – 44)	MW 0.26	0.79 NS
LvEDD (mm)	Mean ± SD Range	32.5 ± 7.16 27 – 54	38.6 ± 9.04 32 - 54	t 1.60	0.13 NS
LvESD (mm)	Mean ± SD Range	24.06 ± 6.87 18 – 44	27.8 ± 9.26 21 - 44	t 1.00	0.33 NS
EF (%)	Mean ± SD Range	62.72 ± 5.89 50 – 75	60.2 ± 10.31 48 - 69	t 0.72	0.48 NS
FS (%)	Mean ± SD Range	32.33 ± 4.03 28 – 43	35.8 ± 1.3 34 - 37	t 1.87	0.08 NS
PASP (mmHg)	Mean ± SD Range	22.5 ± 7.15 12 – 39	27.8 ± 3.19 23 - 30	t 1.59	0.13 NS

Sd: Standard deviation t: Independent t test MW: Mann Whitney test χ^2 : Chi square test NS: Non significant (P>0.05) AO: aorta , LA: left atrium, LvEDD: left ventricle end diastolic

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diameter, LvESD: left ventricle end systolic diameter, EF: ejection fraction, FS: fractional shortening, PASP: pulmonary artery pressure
This table shows that there was no statistical relation between FQRS and ECHO among the studied group postoperative.

Discussion

Early postoperative arrhythmias are a frequent complication after congenital cardiac operation in pediatrics and remains an important factor for a morbidity and mortality [4].

The incidence of acute postoperative arrhythmias in previous studies can be up to 48%. This high incidence of arrhythmias can occur despite of all advancement in surgical technique [5].

In this prospective cohort study 24 patients were enrolled. mean age of patients was 4.39 ± 2.53 years, mean body weight was 18.31 ±6.41kg, mean height was 96.29 ± 19.53 cm, and Regarding sex 54% female and 45% was male.

Regarding general and cardiac examination of patient pre and postoperative we found a statistical significance increase in HR, RR, Temperature and frequency of pallor and hypotension postoperatively like data presented by **Kabbani et al.** [6]**.**

Also, our study showed increasing levels of Na, Mg, K and BUN in patients after surgery in contrast to **Manoj et al.** [7] where all these parameters were within normal levels.

Regarding echocardiography, we have found a statistically significant increase in AO, LvESD and decrease in PASP and FS% postoperative.

About operative data in our study, the mean total time of operation was 1.38 ±0.31 hour, mean CPB time was 48.64 ± 16.35 min, mean ischemic time was 29 ±12.10 min and finally only one cases was arrested.

Our study showed a statistically significance tachycardia (P value= 0.001), cyanosis (P value = 0.02), hypotension SBP (P value =0.001) among cases had arrhythmias compared to those had not, while other examination were statistically non-significant.

Regarding electrolytes, in our study we have found significant increase in K level and decrease in serum Ca, while no significant change in Na and Mg levels were observed in arrhythmic group compared to non arrhythmic one which agree with **Yildirim et al [8]** and not agree with the presenting data of **Manoj et al [7]** .

Regarding arterial blood gases ABG, the statistical analysis showed no significant relation between arrhythmia and ABG among studied group which agree with **Yildirim et al [8].**

In echocardiographic finding, arrhythmias significantly associated with increasing mean PASP range between (30-76 mmHg) (p value = 0.02) and mild decrease of EF% range between (40%-65%) (p value <0.001) which agree with **EL- Boraey et al. [9] w**hile there is no significant change in AO, LA, LvEDD and FS% between both groups.

According to ECG finding among studied group, before surgery, the mean P wave amplitude was 0.12 ±0.06 mv and after surgery was 0.11 ± 0.04 mv which show decrease in postoperative reading but without statistically significant, which agree with **Fang et al [10]**, p wave duration range from 0.06-0.16 sec before surgery, while after surgery was ranged from 0.06 to 0.19 sec with p value = 0.57. also, PR interval was 0.14 ± 0.06 sec preoperative and 0.15±0.06 sec postoperative that show significant increase in PR interval (p value = 0.03) in postoperative patients compared to preoperative which disagree with **Kaya et al [11]** study that show a significant decrease in the PR interval postoperative. The PR interval is determined by the conduction time from the sinus node to the ventricles and thus integrates information about a number of sites conduction systems of the heart. Prolongation of PR interval may result from conduction delay in the atrium, atrioventricular node and/or Hiss purkinji system that may be due to oedema, ischemia and inflammation after surgery.

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According to QRS duration, there was non significant decrease in mean QRS duration in patients after procedure (0.13± 0.04 sec) compared to preoperative ones (0.13± 0.06) in agreement with **Kaya et al [11]**. ST segment was isoelectrical in most of patients per and post-surgery and T wave was depressed in two patients before surgery, and this depression was sustained after surgery and peaked in two patients before surgery and corrected postoperative. Also, there was no statistically significant relationship between arrhythmia and ECG finding in postoperative patients.

Also, we assess the relationship between presence of Fragmented QRS (FQRS) and arrhythmia, and we found a significant statistical association between them, incidence of arrhythmias increased with +ve FQRS **[12]** and to be associated with LV enlargement and VT **[13].**

Fragmentation of QRS complex is defined as the presence of R' or notching of R or S waves in both narrow and wide QRS complex on at least two contiguous leads of those representing anterior (V_1–V_5), lateral (I, aVL, V_6), or inferior (II, III, aVF) myocardial segments. and its important predictor of arrhythmias [12]**.**

FQRS was established as a good marker of myocardial scar in patients with coronary artery disease and patients with congenital heart disease [14].

FQRS included various RSR′ patterns (QRS duration <120 ms), such as ≥1 R prime or notching of the R wave or S wave present.

QRS fragmentation has been identified as a significant factor for arrhythmia in patients with ischemic or Non ischemic heart disease in adult [15]**.**

Also, FQRS was identified in adult patients with correction of fallot's tetralogy, were found to indicate severe dilatation and scarring of Rt ventricle [14].

There is many studies regarding FQRS in adult patients, but these studies were little in pediatrics population.

Also, we found that the incidence of FQRS significantly associated with increasing of mean K and decrease in Ca serum preoperatively which disagree with **Ozkan et al** [16] that show no difference in biochemical parameter between FQRS positive or negative groups.

Other confirmation in our study was that, incidence of fragmented QRS higher in patients how had increasing in mean total time of surgery and longer ischemic time.

All these finding confirm the relation between increasing incidence of arrhythmias in patients had FQRS compared to those had not.

Previous studies have assessed importance of FQRS as a predictor of cardiovascular events in many populations **[15]**

Various explanations associated with CPB time as a causative agent of arrhythmias, as production of inflammatory marker that led to alteration of myocardial membrane potential, release of histamine and ischemic reperfusion injury **[17].**

Study limitation: small number of populations, some laboratory investigation not done as S. Troponin, CKMB and Pronatruretic peptides.

Conclusion: We found Fragmented QRS complex is an important noninvasive tool that help in early detection of occurrence of postoperative arrhythmias.

Recommendation : Further studies on large number of cases are required to validate the results of this study, to identify more risk factor other than our suggested risk factors using prospective cohort study and Further studies required to analyze fragmented QRS and its importance in early detection of arrhythmias and other heart disease in pediatrics.

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