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Ventricular Tachyarrhythmia after Aortic Cross Clamp Release in Cardiac Surgeries

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ABSTRACT

Background: Ventricular tachyarrhythmia (VT/VF) after aortic artery cross clamp release in cardiac surgery is common and the occurrence has been described but the incidence and risk factors are not well defined. This study was designed with the aim to evaluate the prevalence of VT/VF after aortic cross clamp release and to identify risk factors of patients developing such arrhythmias.

Methods: A retrospective observational study 1052 patients over a period of 12 months from March 2011 to February 2012 undergoing various cardiac surgeries with aortic cross clamp were monitored for new-onset ventricular tachyarrhythmia intraoperatively.

Results: The prevalence of ventricular tachyarrhythmia was 24.4%. We found age above 30 years, increasing body mass index (BMI), valvular surgeries and male gender as risk factors for VT/VF after cross clamp release in cardiac surgeries.

Conclusions: Ventricular tachyarrhythmia is common following all cardiac surgeries, especially valvular heart diseases. There is a strong relationship between ventricular arrhythmias and age above 30 years, coronary artery bypass surgery (CABG), high (BMI) and male gender. It is essential for intense monitoring of these patients.

Keywords: Ventricular tachyarrhythmia; cardiac surgery.

INTRODUCTION

Ventricular tachyarrhythmia (VT/VF) can occur as an early complication in the recovery period after cardiac surgery.[1] Non-sustained VT/VF, as a short run of 3 or more consecutive ventricular complexes terminating spontaneously, is common with an incidence of up to 36%.[2] This type of VT/VF is often asymptomatic and may not be associated with increased morbidity or mortality after cardiac surgery. [3] Postoperative sustained VT/VF carries a high risk of mortality in the acute phase and after hospital discharge.[4,5,6] However data on such tachyarrhythmias in local population is unavailable . So this study was designed with the aim to evaluate the prevalence of VT/VF after aortic cross clamp release and to identify associated risk factors of patients developing such arrhythmias.

METHODS

A retrospective observational study was conducted from March 2011 to Feburary 2012 where patients underwent various cardiac surgeries in Shahid Gangalal National Heart Centre. The patients were scheduled for routine surgery and underwent electrocardiogram and hemodynamic monitoring for diagnosis of primary arrhythmias or hemodynamic disturbance in the operation theatre. Standard technique of general anaesthesia was administered to all patients. Cardiopulmonary bypass (CPB) circuit was primed with crystalloid and colloid at 1200 -1500 ml in adult and blood and fresh frozen plasma at 600-800 ml in pediatric. Cold blood with crystalloid cardioplegia were given at 10-15 ml per kg body weight in adult and 20-30 ml per kg in pediatric patients. Lignocain injection was the first-line of treatment for arrhythmias. If there was no response, direct current shock (DC Shock) biphasic 5,10,15,20

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Joules of energy were applied in escalating dose until arrhythmia subsides and refractory VT/VF were treated with amiodarone injection 30 mg/kg over 1 minute. The variables recorded at the time of the primary arrhythmia included age, sex, basal metabolic index (BMI), diagnosis, DC shock , anti arrhythmic drugs, cardiopulmonary pump time, cross clamp time and re cross clamp of aorta. After completion of surgery patients were transferred to Intensive Care Unit. Microsoft excel 2007 was used for data entry purpose. Statistical Product and Service Solution (SPSS) version 16.0 was used to analyze data. Simple descriptive statistics, chi square and simple logistic regression was applied. P- value of less than 0.05 was taken as statistical significance.

RESULTS

The total number of patients included in the study was 1052 and the prevalence of VT/VF was found to be 24.4 % in the study population (table 1).

It was observed that the number of male and female patients were almost the same.

The maximum patients were in the age group of 20-29 years which was 218 (20.7%) and the minimum in the age group of 70 and above which was 26 (2.4%). It was seen that in the age group of 40-49, 54.1% of the patients developed VT/VF (table 2). It was also seen that prevalence of VT/VF in 30 years and above age group was higher in comparison to age group less than 30 (p=0.00) as shown in table 3.

Males were found to have developed VT/VF more than females in the CABG group, 16.5% vs 1.9% (table 4). There was strong correlation between BMI and prevalence of VT/VF in our study. (p=0.000).

The most frequent surgery performed was mitral valve surgery which was 36.2% amongst which one in three (37.8%) developed VT/VF. The second most common surgery was ASD/VSD closure which was 29.7 %, out of which 12.1% developed VT/VF. It was seen that in 14 patients undergoing complex congenital heart disease surgery 50% developed VT/VF (table 5).

Among 77 cases of Intra Cardiac Repair (ICR) only 6.5% developed VT/VF where as among Valve Replacement surgery (VR) 34.4 % developed VTVF in the total cases of 564. Similarly 98 cases of coronary artery bypass graft (CABG), 20.4% developed VT/VF and in ASD/VSD closure out of 313, 12.1 % had VT/VF. When we compared among different types of surgery with ICR, it was seen that occurrence of VT/VF was 7.55, 3.794, 2.045 OR common in VR , CABG and ASD/VSD closure respectively with significant confidence interval (CI) as shown in table 6.

DISCUSSION

In this study, perioperative variables of 1052 patients were taken to provide a more accurate assessment of VT/VF prevalence and associated risk factors. Most studies have evaluated VT/VF after valvular surgery.[5,6,7,8] Similar findings were found in our study with the prevalence of 34.4% in valvular surgery. When we compared with the prevalence of VT/VF among valvular surgery and other groups , there was statistical significance among each groups. One prospective study conducted by Yeung-Lai-Wahetal revealed that the incidence of new-onset sustained postoperative VT/VF was 3.1% in 382 patients undergoing cardiac surgery.[2] In several retrospective studies, the rates of sustained postoperative VT/VF ranged from 0.4% to 1.4% but inherent selection bias in retrospective studies limits the accuracy of the results.[5,6,7] Comparisons between studies are also limited because the definition of sustained postoperative VT/VF varies.

The prevalence of VT/VF seems different among age groups which were statistically significant as shown in study. VT/VF in 30 years and above age group was seen to be significantly higher when compared to the age groups below it (p=0.00). The odds ratio between these two age group was seen as 5.759 (CI 4.18-7.926). In a study by Ducceschi the age more than 60 years was considered a risk factor for VT/VF [9] whereas another study reported older age group.[10] Older patients require more monitoring due to their basic disease.

The prevalence of VT/VF in our study was 20.4% in CABG. It has been seen that coronary artery bypass graft (CABG) was performed more often in mild and moderate LV (left ventricular) dysfunction, but there was an increased incidence of arrhythmias in severe LV dysfunction.[7] So in patients with LV dysfunction, hemodynamic monitoring should be considered to detect VT/VF. Male sex may be a risk factor for Coronary artery disease (CAD) and likely for the severity of CAD and thus VT/VF.[11] Interestingly it was observed that VT/VF was seen to be more commonin males than in females among CABG group (88/10) and was statistically significant (p= 0.000,OR:8.536,CI 10+/-6), however in other type of surgeries both sexes were comparable Ejection fraction (EF) was one of the strongest independent predictors of VT/VF. LV dysfunction is also considered a major predictor of malignant arrhythmias.[8] It is obvious that patients with MI history and low EF because of abnormal scar tissue in myocardium have increased risk of VT/VF. These variable were not measured in our study due to inconsistent availability of data on EF in the records.

There were no statistically significant relationship between electrolyte disturbance and the variety of VT/VF but hypokalemia and hypomagnesemia in the acute

postoperative phase may be considered a predisposing factor for VT/VF.[11] Serial checking in high-risk patients (especially those with history of previous arrhythmia) or use of antiarrhythmic drugs, is highly recommended.

There was strong correlation between BMI and prevalence of VT in our study. (p=0.000).Overweight is a known risk factor for CAD and most patients undergoing CABG have a higher than normal body mass index (BMI) but some studies considered BMI <25 as a risk factor for arrhythmia and others demonstrated BMI >25 as predictor of arrhythmia.[10]

Amiodarone and Lignocain were effective in most cases in our study. The use of antiarrhythmic drugs in Ventricular fibrillation was considerably greater than in the other groups. Beta blockers are considered the most highly effective antiarrhythmic drugs and atorvastatin also has a prophylactic effect.[7] The probability of VT/VF occurrence will reduce in patients who used these drugs before surgery or hospitalization. In our study this factor was not studied.

In view of the strong relationship between ventricular arrhythmias and low ejection fraction, ischemic heart disease, coronary artery disease severity, postoperative myocardial infection, and hemodynamic impairment, continuous monitoring is necessary, especially in the first 48 hours of coronary artery bypass surgery.[11]

CONCLUSIONS

Ventricular tachyarrhythmias are common following all cardiac surgeries, especially valvular heart diseases. There is a strong relationship between ventricular arrhythmias and age above 30 years, CABG, high BMI and male gender. It is essential for intense monitoring of these patients.

Table1. Distribution of patients according to ventricular tachyarrhythmias

Age group	Ventricular Arrhythmia n (%)		p-value
	With VT/VF	Without VT/VF	
0-9	5(3.1)	156(96.9)	
10-19	26(12.9)	176(87.1)	
20-29	32(14.7)	186(85.3)	
30-39	58(46.0)	68(54)	
40-49	100(54.1)	85(45.9)	0.00
50-59	15(15.8)	80(84.2)	
60-69	12(30.8)	27(69.2)	
>70	9(34.6)	17(65.4)	
Total	257(24.4)	795(75.6)	

Table 2. Age distribution of patients

Ventricular Tachyarrhythmia	Number	Percentage
With VT/VF	257	24.4%
Without VT/VF	795	75.6%
Total	1052	100%

Table 3. Relationship between age and VT/VF

Age	Ventricular Arrhythmia n (%)		p-value
	With VT/VF	Without VT/VF	
<30	63(10.8)	518(89.2)	
>30	194(1.2)	277(58.8)	0.00
Total	257(24.4)	795(75.6)	

Table 4. Relationship between sex and type of surgery

SEX	Type Of Surgery n (%)					p-value
	ASD/VSD Closure	AVR	CABG	DVR	ICR	
Male	148(27.7)	18(3.4)	88(16.5)	96(18)	46(8.6)	
Female	165(31.9)	57(5.4)	10(1.9)	126(12)	51(4.8)	
	LA Myxoma Excision	MVR	Repair of CCHD			0.00
Male	0(0)	133(24.9)	5(0.9)			
Female	16(3.1)	248(47.9)	5(1)			

ASD/VSD Closure: Atrial septal defect/Ventricular septal defect closure.

AVR: Aortic valve replacement, CABG : Coronary Artey bypass graft,

DVR: Double valve replacement, ICR: Intra cardiac repair, LA(left atrial) Myxoma Excision, MVR: Mitral Valve replacement, Repair of Complex Congential Heart disease (CCHD) .

Table 5. Relationship between type of cardiac surgery and ventricular arrhythmias

Type of Surgery	Ventricular Arrhythmia n (%)		p-value
	With VT/VF	Without VT/VF	
ASD/VSD closure	38(12.1)	275(87.9)	
AVR	26(45.6)	31(54.4)	
CABG	20(20.4)	78(79.6)	
DVR	24(19)	102(81)	
ICR	0(0)	51(100)	0.00
LA Myxoma Excision	0(0)	16(100)	
MVR	144(37.8)	237(62.2)	
Repair of CCHD	5(50)	5(50)	
Total	257(24.4)	795(75.6)	

Table 6. Comparison between different types of surgery with ICR

Type of surgery (n)	With VT/VF(%)	OR(CI)
ICR(77)	5(6.5)	
VR(564)	194(34.4)	7.55(3-19.002)
CABG(98)	20(20.4)	3.794(2.592-5.555)
ASD/VSD Closure(313)	38(12.1)	2.045(1.214-3.443)

ASD/VSD Closure: Atrial septal defect/Ventricular septal defect closure.

CABG : Coronary artey bypass graft,

VR: Valve replacement Suregry, ICR: Intra cardiac repair

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