Incidence and Predictors of Delirium in Postoperative Coronary Artery Bypass Surgery patients in Pakistani Population

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ABSTRACT

Aim: To study the incidence and predictors of Delirium in post-operative period after Coronary Artery Bypass Surgery in Pakistani population.

Methods: All the patients undergoing CABG were included in this prospective observational study from April 2012 to April 2013. Patients having a redo surgery or emergency surgery were excluded. Patients were assessed by a psychiatrist preoperatively through mini mental scoring system to exclude those with psychiatric disorder preoperatively. Pre-operative, operative and post-operative variables were recorded in a prospective study at a tertiary care hospital. Delirium was diagnosed in post op period using the DSM IV criteria. The results were subjected to logistic regression and Odds ratio was calculated for various variables.

Results: A total of 735(n=735) patients were included in the study of which 577(78.5%) were male while 154(21%) were female. Mean age was 55.64±9.65. Delirium was detected in 161(22%) patients. Logistic regression results indicated that Male gender (OR:1.07,CI 95%:0.205-5.58), Diabetes (OR:4.9,CI 95%:1.25-19.27), previous history of stoke (OR:1.49, CI 95%:0.000-0.00), smoking (OR:3.0, CI 95%:0.54-17.8), below normal haemoglobin level (OR:1.16, CI 95%:0.70-1.97), cross clamp time (OR:1.007, CI 95%: 0.96-1.06), number of bottom end anastamosis (OR:1.58, CI 95%:0.74-3.4), intubation time(6.92 ± 2.82 Vs 18.6 ±15.5) and creatinine (OR:1.04, CI 95%: 0.49-2.18) were independently predicting delirium after coronary artery bypass procedure. Patients with delirium had significantly more length of stay in the ICU (12.62±5.23 in Delirious patients Vs 6.11±1.072, p=0.001 in non-delirious patients).

Conclusion: Delirium is a well-known complication in post Op CABG patients leading to longer hospital stay. Independent predictors of delirium are Male gender, Diabetes mellitus, Previous history of Stroke, Smoking, low Heamoglobin level, Cross clamp time, number of distal anastomosis, creatinine level and intubation time.

Keywords: CABG, Delirium, DSM IV, Pakistani population

INTRODUCTION

Every year, a large number of patients with coronary artery disease undergo Coronary Artery Bypass Grafting and the results are improving with new techniques of myocardial protection and cardiopulmonary bypass. The complications rate is decreasing with the advent of minimally invasive CABG and even robotic surgeries[1].

In spite of so many improvements, the procedure is still not free of complications[2]. Delirium stands a well know complication after CABG associated with increased morbidity, prolonged stay in intensivecare, a longer hospitalization stay and poor outcomes relating to health related quality of life[3].

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Delirium is defined as a disturbance of consciousness and change in cognition, having onset of days to hours with a tendency to fluctuate and often with delusions, agitation and mood lability[4]. A standard defining criteria was given for delirium in the diagnostic and Statistical Manual IV-TR[5].

The incidence of delirium in various patient populations and geographical areas in the world is highly variable as shown by a review of literature from 1963 to 1994 which states the delirium between 3% to 47% in various studies[6]. The reasons for this discrepancy may be the retrospective design of many of these studies and secondly the number of patients included has not been enough to study this multifactorial problem[7].

Delirium after cardiac surgery has proved to be an issue of distress not only for the patients and family but also for the hospital staff. The disease has a sudden onset and fluctuating course, moreover, the ICU staff is not usually sensitized to its presence,

factors which makes its prompt diagnosis and management difficult[8].

A lot of research has been done on the incidence, predictors and precipitating factors of delirium after CABG. Many variables have been studied as a consequence. The current study addresses only those factors which have been associated with delirium more frequently in the previous study and thus validate those results in Pakistani population.

As is evident from the various studies done on the subject, the incidence, risk factors, prognosis and outcome of coronary artery diseases are different in South Asian population[9]. It is very important that delirium be studied in the Pakistani population and the predictors compared to those in the rest of the world.As to date, this study appears the only effort to address the issue in Pakistani population.

MATERIALS AND METHODS

This was a prospective observational study performed at Punjab institute of cardiology from April 2012 to April 2013. All those patients (n=735) undergoing CABG, were included in the study. Patients with emergency surgery and those undergoing a redo procedure and off pump surgery were excluded from the study. The study was approved by the hospital ethical review committee.

A mini mental scoring system examination done with the help of a psychiatrist excluded patients already having cognitive dysfunction. Preoperative, intraoperative and postoperative data was collected on a pre-set proforma. A carotid Doppler study was performed in all patients above the age of 65 years. Cardiopulmonary bypass was used in all the patients.α stat strategy was used for the management of ABG's.

Delirium was diagnosed in the postoperative period using the Diagnostic and Statistical Manual for Mental Disorders (DSM IV) criteria: (1) disturbance in consciousness withreduced ability to focus, sustain, or shift attention;(2) change in cognition or the development of aperceptual disturbance (3) acute onset and fluctuatingcourse and (4) evidence of organic etiological factor.Charge nurses taking care of patients included in the study were made familiar with the diagnostic tools in the criteria and the final diagnosis was made with the help of a psychiatrist.

Data analysis was done through SPSS (version 16, SPSS Inc.). Quantitative variable were presented as mean±Standard Deviation and the qualitative variables were presented as frequency and percentages. For the comparison of the quantitative data, independent sample t-test was applied while for qualitative data chi-square was used. Univariate logistic regression analysis was used to find association of the variables with delirium and to calculate the odds ratio with 95% confidence interval. P-value ≤0.05 was considered as significant.

RESULTS

There were total 735 patients of which 577(78.5%) were male while 154(21.5%) were female. Delirium was detected in 161(22.0%) patients. The demographic and clinical characteristics of the patients are described in table 1 while table 2 represents the results of univariate logistic regression analysis. The mean age of the patients was 55.64±9.65. There was a trend towards higher delirium incidence amongst men. The incidence of the delirium in diabetic patients was 84(52.1%) and in hypertensive patients it was 101(62.7%). The incidence of the delirium in smokers was 95(59.0%). Postoperative delirium was associated with significantly higher Cross Clamp time (83.63±29.22 vs. 55.41±20.19, p=0.001), prolonged Intubation time (18.6±15.5 vs. 6.92±2.82, p=0.001), increased length of intensive care unit stay (12.62±5.23 vs. 6.11±1.072 days, p=0.001), postoperative creatinine levels (1.90±1.29 vs. 1.31±0.72, p=0.003) and number of blood units transfused. Univariate Logistic regression results identified precipitating factors for delirium after coronary artery bypass procedures. They were male gender (OR:1.07,CI 95%:0.205-5.58; P value = 0.93), diabetes (OR:4.9,CI 95%:1.25-19.27; P value = 0.023), previous history of stoke (OR:1.49, CI 95%:0.000-0.001; P-value = 1.00), history of smoking (OR:3.0, CI 95%:0.54-17.8; P value = 0.204), below normal haemoglobin level (OR:1.16, CI 95%:0.70-1.97; P value = 0.55), cross clamp time (OR:1.007, CI 95%: 0.96-1.06; P value = 0.78), number of distal anastomosis (OR:1.58, CI 95%:0.74-3.4; P value=0.24), intubation time (OR:1.983,CI 95%:0.957-1.01; P-value=0.210) and creatinine (OR:1.04, CI 95%: 0.49-2.18; P value=0.93) were independently predicting delirium after coronary artery bypass procedure.

Nagelkerke R2 value in this study analysis was (0.56) which signifies that factors in this study are contributing (65.8%) to delirium. Other factors contributing to delirium were not included in the study and the classification table shows that the test is (85.1%) correct.

Table 1: Demographical and Clinical characteristics of the patients with respect to the Delirium.

		Delirium	Non- Delirium	P-value
Gender	Male	130(80.7%)	390(67.9%)	§0.024*
	Female	31(19.30%)	184(32.1%)	
Age in years		56.96±9.75	55.26±9.64	‡0.423*
Diabetes		84(52.1%)	269(46.8%)	§0.048*
Hypertension		101(62.70%)	287(50.0%)	§0.042*
Smoking		95(59.0%)	191(33.3%)	§0.016*
History of stoke		5(3.1%)	1(0.17%)	§0.001*
Ejection Fraction %		51.85±9.00	49.36±9.95	‡0.245
Pump time (min)		158.3±52.51	156.2±31.60	‡0.056
No. of blood units transfused		2.63±1.28	2.59±0.77	‡0.064
Number of distal anastomosis		3.22±0.75	1.86±0.93	‡0.046*
Hb on the day of symptoms of delirium		7.48±1.72	10.07±1.37	‡0.019*
WBC count post-surgery		1.148±5037.10	1.158±5038.20	‡0.372
Creatinine Post surgery		1.90±1.29	1.31±0.72	‡0.003*
Total stay in ICU (days)		12.62±5.23	6.11±1.072	‡0.001*
Cross Clamp time (minutes)		83.63±29.22	55.41±20.19	‡0.001*
Intubation time (hours)		18.6±15.5	6.92±2.82	‡0.001*

*Statistically significant considered p-value<0.05, §: used for chi-square, ‡: used for independent sample t test.

Table II: Logistic regression model for predictors of delirium after coronary artery bypass surgery.

Predictors		B	Sig.	Odds ratio	95.0% C.I.for EXP(B)	
					Lower	Upper
	age	-.031	.383	.969	.904	1.040
	gender	.067	.936	1.070	.205	5.580
	Diabetes Mellitus	1.590	.023	4.905	1.248	19.271
	Hypertension	-.417	.548	.659	.169	2.568
	Previous history of stroke	18.818	1.000	1.4888	.000	.
	smoking	1.132	.204	3.103	.540	17.827
	EF%	-.029	.415	.972	.907	1.041
	Pump time	-.041	.004	.960	.933	.987
	Blood transfused	-.975	.009	.377	.181	.785
	No of distal anastomosis	.462	.238	1.586	.737	3.416
	Low Hb	.156	.555	1.169	.696	1.965
	Cross.Clamp time	.007	.779	1.007	.960	1.055
	Creatinine	.035	.926	1.036	.492	2.180
	Intubation time	-.017	.210	1.983	.957	1.010
	Constant	7.603	.036	2.0043		

Delirium: as dependent variable

DISCUSSION

Delirium is a consistent finding in the post-operative cardiac surgery patients and can be a source of discomfort to the patients, hospital staff as well as family of the patient. This study focuses only on delirium after Coronary Artery Bypass Grafting. Delirium occurs less frequently after CABG than valve or Valve+CABG surgery[10]. The incidence of delirium after CABG has been quoted from 6% to 54.4% in various studies[3,11]. This vast discrepancy in incidence can be due to an array of definitions used to define delirium. Different terms have been used for the post-operative neurological phenomenon ranging from confusion, encephalopathy, agitation, cognitive dysfunction to acute brain syndrome. Since the

publication of the Diagnostic and Statistical Manual IV in 2000, a standard definition was given.

As the research on the subject has proved, delirium is a multifactorial disease occurring in the postoperative period[12]. The causation is an interplay among the preoperative, intraoperative and postoperative factors[13]. Many factors have been ascribed to the causation of delirium in postoperative delirium patients worldwide in different population segments[14].

The current study showed an association of male gender with the development of Delirium after CABG. Perttiet al confirmed this association[3]. Some studies do not identify male gender as a predictor in this regard[15] while still others haven't found any significant difference with respect to gender[16].

Our study shows a strong predictive value of diabetes mellitus for delirium in postoperative CABG patients. Mu et al[17] showed a four folds increase of delirium postoperatively in diabetic patients. Similarly, other investigators have supported this through their studies[18, 19]. Diabetes mellitus increases the risk of atherosclerotic complications and this may explain the increased incidence of delirium in these patients[20].

This study establishes the well known relationship between POD in CABG patients and preoperative smoking. These patients have narcotic tolerance and they need a higher dose of these medications for analgesia[21]. Morphine and meperidine have been linked to POD in other studies[22].

Many embolic phenomena and thus neurologic sequelae have been attributed to the aortic cross clamping[23]. Our study showed that the longer the cross clamp time of the aorta, the more are the chances of delirium postoperatively. Izabela et al[24] have shown the same through a retrospective study. Our study confirmed their findings through a prospective design. But on the other hand, some investigators have shown the aortic cross clamp time to be predictor of CVA but not delirium[25].

This study proves a predictive valve of the number of bottom end anastomosis for the development of POD in CABG patients. This association seems to be because of the higher pump time in such patients which has been an independent predictor itself. Norkiene et alshowed very weak association of the number of distal end anastomosis with Delirium but statistically insignificant[16]. Further research on this topic is needed.

Our study showed six times more association of delirium with prolong intubation time. This is in consistency with findings by Bojanet al[18], Lin Y et al[19]. Administration of various anaesthetic drugs for prolong intubation could explain this as these drugs may affect the central nervous system activity. Longer intubation time can also predispose patients to respiratory infections which may then precipitate delirium[26].

Abnormal creatinine and associated rising blood urea nitrogen levels have been associated with neurological consequences[27]. The current study shows a strong predictive valve of abnormal creatinine with POD in CABG patients. The study confirms the finding by many previous studies[15, 28, 29].

A below normal haemoglobin level postoperatively was associated with delirium. Low haemoglobin lead to increased usage of blood products and this might be the cause for delirium as proved by other investigators[16, 30]. Whether it is the use of intraoperative blood products or postoperative, is yet to be elucidated through research.

The delirious patients in this study had prolonged course in the hospital. They stayed for a longer duration in the ICU. This finding concurred with previous reports[8].

Koster et al suggested that patients with less cognitive reserves preoperatively had more chances of developing delirium after surgery[31]. Our study excluded such patients altogether by assessing the patients preoperatively through Mini Mental Scoring Examination.

A previous history of stroke was recognised to be a predictor of delirium in literature[32]. Our study confirms this finding.

Our study is a prospective design which makes it a more reliable way for studying the predictors of this important complication in postoperative cardiac surgery patients. Secondly, the large sample size studied adds to the credibility of the results. We involved psychiatrists who trained the staff nurses for initial assessment of the patients for signs of impaired cognition and upon pointing out any such abnormality; a proper evaluation was done by the psychiatrist himself to diagnose delirium. The standard protocol for diagnosing delirium under DSM IV was used to remove any ambiguity in the final diagnosis.

This study has some limitations nonetheless. We didn't include age as a study variable in this study. Age has been identified a predictor in such settings in previous studies [33, 34, 35].

An epi-aortic ultrasound is a sensitive and specific tool for detecting atherosclerotic changes in the ascending aorta which is the site of cannulation[36]. Our study doesn't use this for to identify patients at high risk of microembli to the brain and resulting delirium.

Postoperative low cardiac output syndrome has not been considered which is a recognized precipitating factor of delirium[37].

It can be concluded that the incidence of post-operative delirium in Pakistani population is very much consistent with that mentioned in international literature. Delirium after CABG surgery increases the length of stay in ICU and adds to the morbidity. Staff nurses and doctors looking after post-operative CABG patients should be sensitized to this important post-operative complication.Independent predictors of delirium are male gender, diabetes mellitus, previous history of stroke, smoking, low Heamoglobin level, cross clamp time, number of distal anastomosis, creatinine level and intubation time.

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