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Evaluation of the Prevalence and Risk Factors of Delirium in Cardiac Surgery ICU

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ABSTRACT

Introduction: Delirium is defined as an acute cognitive disorder presenting with fluctuation in cognition, apathy and non-organized thinking. It may increase morbidity, mortality, ICU stay and cost. In patients who underwent heart surgery delirium may increase post-operative complications such as respiratory insufficiency, sternum instability and need to re-operation of the sternum. The aim of this study was to evaluate the prevalence and risk factors of delirium in patients admitted to cardiac surgery.

Materials and Methods: 18 years or older patients who had undergone cardiac surgeries and stayed for more than 24 hours in ICU following surgery were recruited. All subjects were assessed for signs & symptoms of delirium using CAM-ICU and its risk factors. All data were analyzed by SPSS 16 at the end of the study.

Results: The prevalence of delirium in these patients was 23.5% (47 patients). The mean age of patients with delirium was more than other patients (P=0.001). The Incidence of delirium in the patients with cardiopulmonary bypass surgery (CPB) was higher than the patients without CPB (P=0.01). The Incidence of delirium in the patients with Atrial fibrillation was higher than patients without it (P=0.002). The Incidence of delirium in the patients with CVA history was higher than the patients without CVA history (P=0.032). The mean time of mechanical ventilation in the delirious patients was more than other patients (P=0.01).

Conclusion: Older Age, CPB, history of CVA, Atrial Fibrillation, and prolonged mechanical ventilation are considered as the risk factors of delirium in cardiac surgery patients.

Introduction

Delirium is defined as an acute cognitive disorder that presents with fluctuation in cognition, apathy and non-organized thinking. Delirium also is incorrectly named as ICU psychosis or ICU syndrome.[1] It may increases morbidity, mortality, ICU stay and cost. Cognitive impairment after recovery from delirium may be long-lasting and the functional ability and quality of patient life may be affected.[2] In patients with cardiac surgery, delirium may increase post-operative complications such as respiratory insufficiency, sternum instability and need for re-operation the sternum.[3] Some of the patients who have delirium in hospital may present signs of delirium after discharge. In these patients brain activity and cognition declines and the risk of dementia increases in comparison with the patients without a history of delirium.[4] If the patient suffers hyperactive delirium, complications such as self-extubation, exit of life-saving catheters and asynchrony between patient and ventilator are increased which may be associated with poor prognosis.[4] Hence, the study of prevalence and risk factors of delirium in patients undergoing cardiac surgeries in the ICU seems quite necessary. Finding the risk factors of delirium might assist early detection and reduction in risk of complications. Elimination of some known risk factors of delirium may cause reduction the length of stay, mortality and morbidity.

The aim of this study was to evaluate the prevalence and risk factors of delirium in patients admitted to cardiac surgery ICU.

Materials and Methods

In a descriptive-prospective study, after obtaining approval from the Ethics Committee of the university and written informed consent from the patients, all patients admitted to the ICU following cardiac surgery were evaluated for delirium by means of CAM–ICU (Confusion assessment method of ICU).

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Inclusion criteria were: Age above 18 years, cardiac surgery and stay in the ICU for more than 24 hours. Exclusion criteria were: unwillingness, history of psychological illness and antipsychotic drugs, patient death, hearing or vision disorders, RASS (Richmond Agitation sedation scale) less than or equal to – 4 and inability to respond to questions.

Change in consciousness state in the past 24 hours was assessed using ASE (Attention screening Examine). In this method, 10 letters were said to the patient and later the patient was asked to shake the examiner's hand when special character such as (a) was heard. If the number of correct answers was less than 8, the patient was neglected. Visual Version of this test was used for patients in which squeezing the examiner's hand could not be applied. Unorganized thinking was measured by patient answering to 4 yes or no questions. Patients who failed to respond to two questions correctly were considered to have unorganized thinking. The changes in level of consciousness of patients were evaluated with RASS. Patients with acute changes in conscious state and those with neglect, unorganized thinking or altered level of consciousness were considered to have delirium using the CAM-ICU. Risk factors of delirium in these patients were recorded and statistically analyzed. Data were analyzed by descriptive statistics (frequency, percent, mean ±SD), mean difference test for independent samples, Fisher's exact test and analysis of variance (one-way ANOVA). In this study, P values of less than 0.05 were considered statistically significant .

Results

Of 200 patients enrolled in this study, 47 had delirium. The prevalence of delirium in this study was 23.5%. (21 cases hyperactive, 12 cases hypoactive and 14 were mixed type delirium) (Figures 1 and 2). The mean age of the patients was 53.33±11.42 years (64.27±9.72 in delirium Patients, and 56.41±12.36 in Patients without delirium). There was a significant relationship between age and risk of delirium (*P*=0.001). 151 patients (75.5%) were operated with and 49 patients (24.5%) without CPB (Cardio Pulmonary Bypass). From 47 patients with delirium, 44 patients had operation with CPB but just 3 patients had operation without CPB. Prevalence of delirium in patients undergoing surgery using CPB was 29.13% and in the patients without CPB 6.12%. There was a significant relationship between surgery with CPB and the risk of delirium. (*P*= 0.001; Figure 3). The average ICU stay of delirium patients was 8.78±5.23 days and in Patients without delirium was 3.23±1.02 days, There was a significant relationship between delirium and ICU stay (*P*=0.01). Of the 47 patients who developed delirium, 8 patients had a history of CVA (17%) in comparison with 9 (8.5%) patients without delirium but had a history of CVA. There was a significant relationship between history of CVA and the risk of delirium. (*P*=0.032). Among the 47 patients with delirium 8 (2.17%) patients had atrial fibrillation but 4 patients (6.2%) in delirium-free group had atrial fibrillation. There was a significant relationship between atrial fibrillation and delirium (*P*=0.002). Duration of mechanical ventilation in delirium patients was 49.36±13.54 hours and 20.19±6.43 hours in delirium-free group. There was a significant correlation between the duration of mechanical ventilation and the incidence of delirium (Table 1).

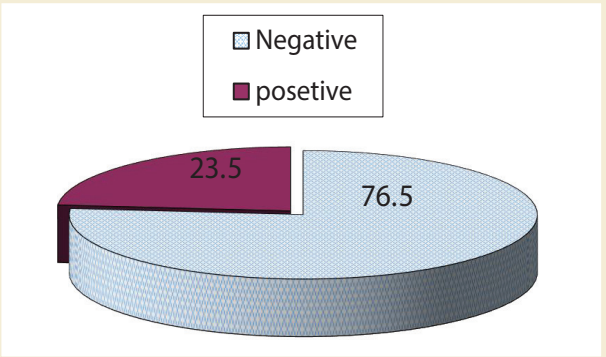

Figure 1. The frequency of delirium in patients after cardiac surgery

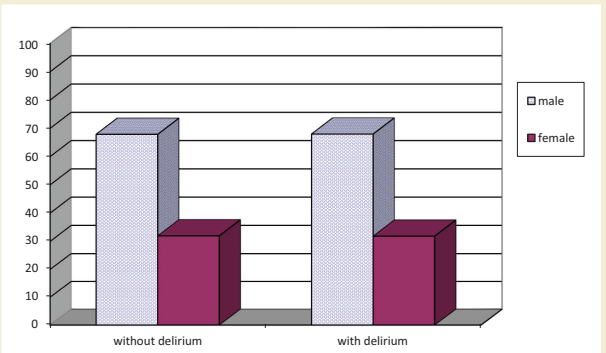

Figure 2. Frequency of sex in the study population

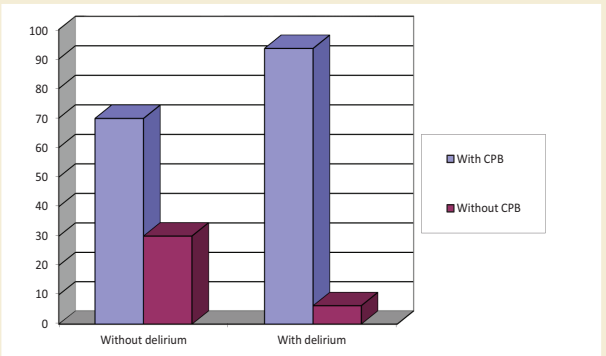

Figure 3. Frequency of CPB in patients after cardiac surgery

Table 1. Factors considered in the study.

	With delirium N=47 n(%)	Without delirium N=153 n(%)	*P*
Age (year)	64.27 ± 9.72	56.41 ± 12.36	0.001
Sex	32 (68%)	104 (67.9%)	0.9
CPB	44 (93.6%)	107 (69.9%)	0.01
Duration of MV (Hour)	49.36 ± 13.54	20.19 ± 6.43	0.01
Diabet	25 (53.1%)	76 (49.6%)	0.66
CVA	8 (17%)	9 (5.8%)	0.032
Electrolyte abnormality	13 (27.6%)	36 (23.5%)	0.53
Thyroid disorder	1 (2.1%)	4 (2.6%)	0.80
Acid/base abnormality	11 (23.4%)	31 (20.9%)	0.64
Renal failure	5 (10.6%)	18 (11.7%)	0.87
Liver disease	1 (2.1%)	3 (1.9%)	0.89
Heart failure	5 (10.6%)	21 (13.7%)	0.59
Recent MI	12 (25.5%)	31 (20.2%)	0.38
Hypertension	36 (76.59%)	120 (78.43%)	0.82
Smoking	28 (59.5%)	95 (62%)	0.77
Bun/Cr>18	6 (12.7%)	20 (13%)	0.84
Anxiety	17 (36.1%)	53 (34.6%)	0.64
Arrhythmia	9 (19.1%)	24 (15.6%)	0.51
Atrial fibrillation	8 (17.2%)	4 (2.6%)	0.002
Hypoglycemia	1 (2.1%)	3 (1.96%)	0.9
Cessation narcotic drugs	2 (4.2%)	6 (3.9%)	0.71
Shock	2 (4.2%)	6 (3.9%)	0.86
Hyperthermia	9 (19.1%)	25 (16.33%)	0.55
Motion limitation	2 (4.2%)	8 (5.2%)	0.69
Sleep Disorder	20 (42.5%)	61 (39.8%)	0.67
Hypoxemia	1 (2.1%)	4 (2.6%)	0.8
Cr>2	5 (10.6%)	18 (11.7%)	0.87
Medications associated with delirium	26 (55.3%)	82 (53.5%)	0.79
Tube feeding>24h	11 (23.4%)	38 (24.8%)	0.81

Discussion

Delirium is defined as an acute cognitive impairment and neglect which fluctuate in level of consciousness or altered level of consciousness with unorganized thinking.[1] This disorder causes increased mortality, morbidity, length of ICU stay and in patients undergoing cardiac surgery.[3] Delirium is divided into hypoactive, hyperactive and mixed types. In Hypoactive type, patients are quiet but neglected and with decreased motion. In Hyperactive type, patients are agitated. The main characteristic of delirium is inattention. Hypoactive type is associated with a poor prognosis.[4] In Bucerius study, it was indicated that surgery without CPB (off-pump) and the early age of the patients significantly decrease delirium in cardiac surgical patients.[5] In our study, atrial fibrillation and history of CVA were identified as risk factors of delirium; also CPB was significantly associated with delirium. Because of the difference in the assessment method of delirium, the incidence of delirium in this study was lower than our study. In addition, thanks to a larger sample size, this study identified more significant factors for delirium, for example, in this study diabetes mellitus was identified as a risk factor of delirium but in our study there was no significant relationship between diabetes mellitus and delirium.

In Nagpul study on patients undergoing CABG with or without CPB, the mortality, postoperative myocardial infarction and renal failure were not different between the two groups; however, there was significant relationship between delirium and other neurological dysfunctions in two groups. In this study, 2.3% of patients undergoing off-pump CABG and 12.5% of on-pump CABG suffered from delirium (P= 0.01).[6] In our study, there was a significant association between delirium and CPB. In the

Hernandez study, no significant relationship was reported between delirium and other neurological dysfunctions in two groups.[7]

Possible reasons for the higher prevalence of delirium in patients who have undergone surgery using CPB are periods of hypotension during CPB and non-pulsatile blood flow during surgery, but a lower risk of delirium in off-pump patients can be due to the fact that ascending aorta is not canalized thus reducing the risk of atherosclerotic embolization.[8]

In Kazmierski Study, the prevalence and risk factors of delirium were assessed in patients undergoing cardiac surgery with CPB using the DSM-IV (Diagnostic and statistical Manual of Mental disorders IV). The incidence of delirium in this study was 16.3%, and the factors that significantly associated with delirium were: age, preoperative cognitive impairment, episodes of major depressive disorder, anemia, atrial fibrillation, duration of mechanical ventilation. These results are in line with our study. Atrial fibrillation, advanced age, and prolonged mechanical ventilation in our study also had a significant association with delirium.[9]

AF may cause delirium by the risk of cerebral embolism, hypoperfusion and periods of arterial hypotension. On the other hand due to hypoperfusion, cerebral hypoxia probability may increases and this can reduce synthesize of acetyl coenzyme A, glutamate and acetylcholine in the citric acid cycle. The activity of brain cholinergic and glutaminergic fall could be responsible for delirium.[10]

In Rudolph study, delirium risk factors were examined using CAM-ICU in 122 patients aged over 60 years who underwent cardiac surgery. The incidence of delirium in this study was 52% and factors that were significantly associated with delirium were abnormal levels of serum albumin, depression, cognitive disorders, and a history of CVA.[11] The incidence of delirium in this study was greater than our study due to the age of the participants in this study. Also history of CVA was considered as an underlying cause of delirium in our study but abnormal levels of serum albumin and depression were not monitored.

In Reissmuller study, 107 patients undergoing cardiac surgery were evaluated for delirium using CAM-ICU. The incidence of delirium in this study was 23% and risk factors were age over 60 years, longer duration of mechanical ventilation and longer CPB time, which is in line with our study.[12] In Norkiene study, the assessment of risk factors for delirium in patients undergoing cardiac surgery using DSM-IV was performed. The incidence of delirium in this study was 31% and risk factors were: atrial fibrillation, use of IABP (Intra-Aortic Balloon Pump), Intraoprative hemofiltration, age over 65 years, emergency cardiac surgery, peripheral vascular disease, diabetes and hypertension.[13] Being line with our study, atrial fibrillation, age, diabetes and hypertension were mentioned as risk factors for delirium; however, IABP and hemofiltration were not examined in our study. In Chang study, delirium and its risk factors after cardiac surgery were evaluated in 288 patients using DSM-IV. The incidence of delirium was 41.7% and the factors that were significantly associated with delirium were age over 65 years, mechanical ventilation more than 24 hours, infection after surgery, hematocrit less than 30% and a history of CVA.[14] In comparison with our study, the incidence of delirium was higher in this study that may be due to differences in the assessment method of delirium. Age, prolonged mechanical ventilation and previous CVA in our study were significantly associated with delirium; however, hematocrit effect was not investigated in our study.

In Banach study, delirium and its risk factors were assessed in 260 patients after heart surgery using the DSM-IV. The incidence of delirium in this study was 11.2% and factors significantly associated with delirium were dysrhythmias (atrial fibrillation), hypertension, history of CVA, operation time more than 3h and alcohol abuse.[15] The incidence of delirium in this study was lower than our study because of their exclusion criteria. The history of CVA and atrial fibrillation in our study significantly associated with delirium but not with hypertension which might have been due to smaller sample size of our study.

In summary, the incidence of delirium varies from 8.4% in Bucerius study to 41.7% in Chang study. These differences could be due to differences in assessment method of delirium, method of study and sample size. In our, Bucerius, Rudolph and Chang studies, the history of CVA was identified as one of the risk factors for delirium. In our, Kazmierski, chang and Veliz studies, prolonged mechanical ventilation was known as a risk factor for delirium, properly due to poor general health condition in patients with prolonged mechanical ventilation and respiratory failure. On the other hand, receiving anesthetics and muscle relaxants could have affected their mental function.[16]

Atrial fibrillation in our and Banach, Norkieue and Bucerius studies was significantly associated with the delirium that may due to increased risk of cerebral emboli and hypoperfusion and arterial hypotension. Cerebral hypoperfusion and hypoxia can decrease the cholinergic and glutaminergic function of the brain that could be the underlying cause of delirium.

Diabetes and hypertension were considered as risk factors of delirium in Bucerius, Bazach and Norkieue studies; however, we could not find any significant relationship between them; as previously discussed, this could be due to differences in the sample size.

In our and in Bucerius and Ncegpel studies, there was a significant association between delirium and surgery with CPB, but in Hernandez study there was not any significant differences between off-pump surgery and delirium which may be due to the lack of sclerotic embolization after canalization of ascending aorta in off-Pump method.

Conclusion

Our study revealed that cardiac surgery using CPB, older age, history of CVA, atrial fibrillation and prolonged mechanical ventilation are considered as risk factors of delirium. By identifying the factors of delirium in ICU patients and early detection and treatment of delirium complications can be prevented. Therefore, it is recommended that, according to the prevalence of delirium, daily scoring patients with CAM-ICU by caregiver is a simple and non-time consuming method that can be helpful in early detection and prevention of complications. Identifying patients with high Risk of developing delirium based on known risk factors can help early detection of delirium. Treatment of atrial fibrillation after heart surgery could possibly be helpful in reducing delirium; however further studies are required to confirm this hypothesis.

Ethical issues: This study was reviewed and confirmed by the ethics committee of Tabriz University of Medical Sciences.

Conflict of interests: The authors declare no conflicts of interest.

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