

## Original article

# Effect of preoperative cognitive dysfunction on postoperative outcomes in cardiac surgery

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**Background:** Preoperative cognitive dysfunction (PreOCD) has not been as well described as a risk factor for poor outcome in cardiac surgery. This study was aimed to demonstrate the effect of PreOCD on postoperative outcomes in cardiac surgery.

**Methods:** One hundred adult patients undergoing elective open cardiac surgery at King Chulalongkorn Memorial Hospital were recruited. Montreal Cognitive Assessment (MoCA) was used to evaluate cognitive function in the evening before surgery and defined the score that is less than 26 as cognitive impairment. We compared postoperative outcome data between patients with PreOCD group and without PreOCD group.

**Results:** One patient in PreOCD group withdrew from our study. Sixty nine out of 99 patients (68.31%) had PreOCD. In PreOCD group, postoperative mechanical ventilation period was significantly longer ( $15.9 \pm 26.6$  vs.  $7.4 \pm 8.76$  hours,  $P = 0.018$ ), ICU stay was significantly longer ( $39.9 \pm 43.7$  vs.  $27.6 \pm 15.0$  hours,  $P = 0.039$ ), and cost of hospital stay was significantly higher ( $13,540 \pm 6,355$  vs.  $11,264 \pm 5,229$  baht,  $P = 0.014$ ).

However, the length of hospital stay was not significantly different ( $10.1 \pm 3.8$  vs.  $9.3 \pm 4.4$  days,  $P = 0.384$ ).

**Conclusions:** We demonstrated the adverse effect of PreOCD on patients outcomes after cardiac surgery. Identifying PreOCD may be useful in risk stratification during preoperative assessment to improve surgical outcome.

**Keywords:** Preoperative cognitive dysfunction, cardiac surgery, postoperative outcome, cognitive assessment.

Postoperative cognitive dysfunction (POCD) is a common complication after both cardiac and non-cardiac surgery in elderly patients. The incidence of POCD persisted for 6 months after surgery occurs about 10 - 30% in cardiac surgical patient.<sup>(1)</sup> Several studies showed adverse postoperative outcomes in patients with POCD. A multicenter cohort study with 701 patients demonstrated the association between POCD and prolonged the length of hospital stay, recovery time and increased one-year mortality rate.<sup>(2)</sup> Patients with POCD also loss their functional independence that leads to disability.

Several studies indicated association of preoperative cognitive dysfunction and postoperative morbidity especially in the elderly. A cohort study found that elderly patients with mild cognitive impairment were associated with pulmonary complication after CABG.<sup>(3)</sup> Robinson's study also found that preoperative cognitive dysfunction (PreOCD) was associated with postoperative delirium, longer hospital stays, higher rate of discharge, institutionalization and six-month mortality.<sup>(4)</sup> However, when compared with POCD, there were less information regarding preoperative cognitive dysfunction with vary results. This study was aimed to demonstrate the effect of preoperative cognitive dysfunction on postoperative outcomes in cardiac surgery.

## Methods

### Study population

After institution review board having approved our study project, we recruited 100 consecutive

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patients who presented at King Chulalongkorn Memorial Hospital for elective cardiac surgery facilitating cardiopulmonary bypass from July 2015 to October 2016. The inclusion criteria were 18 - 65 years-old patient who had left ventricular ejection fraction more than 30% and serum creatinine level less than 2 mg/dL in male and 1.5 mg/dl in female. The exclusion criteria were history of symptomatic cerebrovascular diseases, psychiatric problems or other neurological diseases. Conditions that prevented participation in the assessment such as the patients who had hearing and visual impairment as well as inability to understand Thai language also excluded. Written information completed by the patients before recruitment.

**Cognitive assessment**

Preoperative cognitive function was assessed in all participants in the evening before surgery. We used Montreal Cognitive Assessment (MoCA) for screening of cognitive impairment. This is a one-page, 30-point test which can be completed in about 10 minutes. This test has already been translated into Thai and validated for Thai population.<sup>(5)</sup> Eight domains were assessed including visuospatial and executive function, naming, memory, attention, language, abstraction, delayed recall and orientation. The test also compensates for educational level by giving an additional point for any patients graduated below grade 12. MoCA is independent of gender, and correlates well with age. The reported sensitivities for detecting mild cognitive impairment were 83% - 90% and specificities were

50% - 87% varying to health, age and cognitive background.<sup>(6-9)</sup> We defined PreOCD as MoCA score below 26.

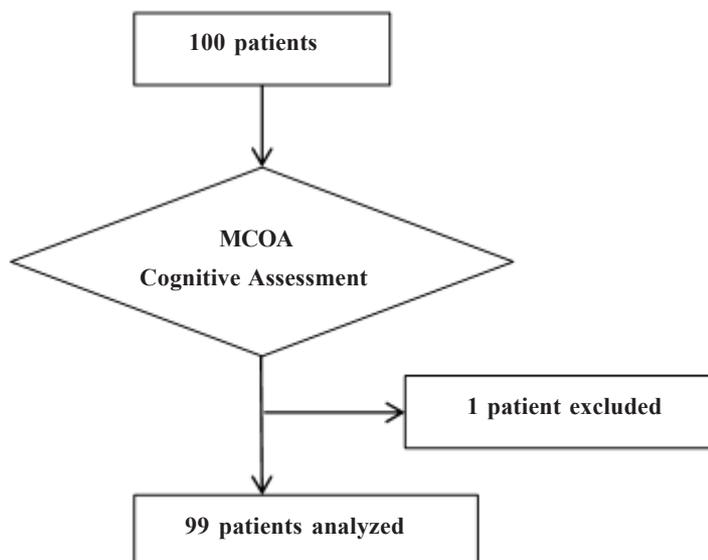
**Outcome measurement**

Our subjects were divided into two groups regarding to the presence or absence of PreOCD. One subject in PreOCD group refused to continue in the study due to personal reason. As a result, 99 patients were eligible for data analysis (Figure 1).

We compared data regarding duration of postoperative mechanical ventilation, duration of ICU stays, length of hospital stays as well as calculated cost of hospital stay between groups. The cost of hospital stay was based on the charge rate occurred to patients in our institute. For instance, charge of hospital bed per day is 1,400 baht for ICU and 400 baht for general ward. Continuous vital signs monitoring in the ICU cost is 1,000 baht per day. Charge for ventilator support during ICU stay is 1,900 baht per day.

**Statistical analysis**

All statistical analyses were performed using SPSS software (version 23). Data were expressed as mean ± standard deviation (SD) for continuous data and number (percentages) for categorical data. Comparison between groups were made using non-parametric testing which were Mann-Whitney-U test for continuous data and Chi-square test for categorical data. *P* - value less than 0.05 was considered statistically significant.



**Figure 1.** Study flow diagram.

## Results

The number of eligible patients for data analysis was 99. Demographic data between both groups were shown in Table 1. The prevalence of preoperative cognitive dysfunction was 69%. The mean and SD of MoCA test score for preoperative cognitive dysfunction group was  $21 \pm 3.4$  comparing to  $27.1 \pm 1.1$  in the other group. There was no difference between both groups in terms of age, weight, body mass index (BMI), serum creatinine level and left ventricular ejection fraction (LVEF).

We found adverse postoperative outcomes in PreOCD group, as shown in Table 2. Time required for mechanical ventilation was significantly longer ( $15.9 \pm 26.6$  hours vs.  $7.4 \pm 8.76$  hours;  $P = 0.018$ ). Also, length of ICU stay was significantly longer ( $39.9 \pm 43.7$  hours vs.  $27.6 \pm 15.0$  hours;  $P = 0.039$ ). However, length of hospital stay was not statistically significantly different between both groups ( $10.1 \pm 3.8$  days vs.  $9.3 \pm 4.4$  days;  $P = 0.384$ ). Additionally, the calculated cost of hospital stay was significantly higher in PreOCD group ( $13,540 \pm 6,355$  baht vs.  $11,264 \pm 5,229$  baht,  $P = 0.014$ ).

## Discussion

More than half of the patients in our study had PreOCD as defined by the MoCA score less than 26. The prevalence of preoperative cognitive impairment in previous study varied as age range and health background of study population and diagnostic criteria of each research.<sup>(6, 7, 10, 11)</sup> PreOCD is rather common in elective surgical patients. Moreover, subtle cognitive impairment can be easily missed. As a result, prevalence among studies may be underestimated. Our study demonstrated the relationship of PreOCD on patients' postoperative outcomes in cardiac surgical patient. PreOCD was found to associated with prolonged mechanical ventilation, longer ICU stay and increased cost of hospital stay when compared with those who did not have PreOCD.

Although preoperative cognitive dysfunction is not routinely screened in preoperative evaluation, it may be a useful indicator for risk stratification during preoperative screening and potentially facilitate risk reduction.<sup>(12)</sup> Although formal neuropsychological test may be effective in diagnosing mild cognitive

**Table 1.** Characteristics of the patients.

	PreOCD	No PreOCD	Overall
Number	69	30	99
MoCA score	$21.0 \pm 3.4$	$27.1 \pm 1.1$	$22.9 \pm 4.0$
Age (year)	$54.0 \pm 11.0$	$48.0 \pm 14.0$	$52.0 \pm 12.0$
Weight (kg)	$61.0 \pm 12.0$	$61.0 \pm 14.0$	$61.0 \pm 12.0$
BMI (kg/m <sup>2</sup> )	$23.3 \pm 3.2$	$23.1 \pm 3.6$	$23.3 \pm 3.3$
Serum creatinine (mg/dL)	$1.9 \pm 7.7$	$1.8 \pm 4.4$	$1.9 \pm 6.9$
LVEF (%)	$60.0 \pm 14.0$	$66.0 \pm 9.0$	$62.0 \pm 13.0$

BMI: Body mass index; LVEF: Left ventricular ejection fraction; MoCA: Montreal Cognitive Assessment.

**Table 2.** Postoperative outcomes.

	PreOCD (n = 69)	No PreOCD (n = 30)	P - value
Mechanical ventilation (hour)	$15.9 \pm 26.6$	$7.4 \pm 8.8$	0.018
ICU stay (hour)	$39.9 \pm 43.7$	$27.6 \pm 15.0$	0.039
Length of hospital stay (day)	$10.1 \pm 3.8$	$9.3 \pm 4.4$	0.384
Calculated cost hospital stays (baht)	$13,540 \pm 6,355$	$11,264 \pm 5,229$	0.014

ICU: Intensive Care Unit.

impairment, it may not be practical in our routine preoperative anesthetic and surgical evaluation. MoCA test, widely validated as an effective screening tool for mild cognitive impairment, may be an alternative in this situation due to its simplicity and ease of use.

This is an observational study. For more applicability of future research, study in the aged population and explore the long-term outcome would be more beneficial. Controlling anesthetic regimen, targeted sedation protocol in ICU and the ICU discharge criteria should be defined. Measuring time required to complete ICU discharge criteria rather than actual time spent in the ICU might be more clinically relevant. Additionally, assessment of postoperative cognitive dysfunction and postoperative delirium should be evaluated.

### Conclusion

We demonstrated the adverse effect of PreOCD on patient's outcomes after cardiac surgery such as prolonged duration of mechanical ventilation, prolonged ICU and cost of hospitalization. Identifying PreOCD may be useful in risk stratification during preoperative assessment to improve surgical outcome.

### Conflict of interest

None of the authors has any potential conflict of interest to disclose.

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