**The Effect of Preoperative Cognitive Dysfunction on Postoperative Outcomes in Cardiac Surgery**

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**Absrtact**

**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 enrolled. Montreal Cognitive Assessment (MoCA) was used to evaluate cognitive function in the evening before surgery and defined score 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 longer (15.9±26.6 VS 7.4+8.76 hrs., p =0.018), ICU stay was longer (39.9±43.7 VS 27.6±15.0 hrs, p= 0.039), and cost of hospital stay was higher (13,540±6,355 VS 11,264 ± 5,229 baht, p=0.014). However, length of hospital stay was not significantly different (10.1±3.8 VS 9.3±4.4 days, p = 0.384).

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

**Keyword**: Preoperative cognitive dysfunction, cardiac surgery, postoperative outcome, cognitive assessment

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**Introduction**

Postoperative cognitive dysfunction (POCD) is a common complication after both cardiac and non-cardiac surgery in elderly patients. The incidence of POCD persisted 6 months after surgery occurs about 103-30 in cardiac surgical patient.(1) Several studies showed adverse postoperative outcomes in patients with POCD. A multicenter cohort study with 701 patients demonstrated the association between POCD and prolonged length of hospital stay, recovery time and increased one-year mortality rate.(2)The patients with POCD also loss their functional independence which 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 was associated with pulmonary complication after CABG.(3) 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.(4)However, comparing 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.

**Methodology**

**Study population**

 After institution review board approved, we included 100 consecutive patients presenting to King Chulalongkorn Memorial Hospital for elective cardiac surgery facilitating cardiopulmonary bypass from July 2015 to October 2016. The inclusion criteria were 18-65 year-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 hearing and visual impairment as well as inability to understand Thai also excluded the patients into our study. Written information was provided and written informed consent were completed.

**Cognitive assessment**

Preoperative cognitive function was assessed in all the 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 populations.(5) 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, 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.(6-9)We defied 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).

Figure 1: Study flow diagram

100 patients

MCOA

Cognitive Assessment

99 patients analyzed

1 patient excluded

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 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 are Mann-Whitney-U test for continuous data and Chi-square test for categorical data. P-value less than 0.05 was considered statistically significant.

**Results**

The number of patients eligible for data analysis was 99. Demographic data between both group was 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 ± 3.4 comparing to 27.1 ± 1.1 in the other group. There was no difference between both group in term of age, weight, body mass index (BMI), serum creatinine level and left ventricular ejection fraction (LVEF).

**Table 1**: Characteristics of the patients

|  |  |  |  |
| --- | --- | --- | --- |
|  | PreOCD | No PreOCD |  Overall |
| Number | 69 | 30 | 99 |
| MoCA score | 21 ± 3.4 | 27.1 ± 1.1 | 22.9 ± 4.03 |
| Age | year | 54 ± 11 | 48 ± 14 | 52 ± 12 |
| Weight | kg | 61 ± 12 | 61 ± 14 | 61 ± 12 |
| BMI | kg/m2 | 23.3 ± 3.2 | 23.1 ± 3.6 | 23.3 ± 3.3 |
|  Serum creatinine | mg/dL | 1.9 ± 7.7 | 1.8 ± 4.4 | 1.9±6.9 |
| LVEF | % | 60 ± 14 | 66 ± 9 | 62 ± 13 |

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

**Table 2:** Postoperative outcomes

|  |  |  |  |
| --- | --- | --- | --- |
|  | PreOCD(n=69) | No PreOCD(n=30) | *P-value* |
| **Mechanical ventilation** | **hour** | 15.9 ± 26.6 | 7.4 ± 8.76 | *0.018* |
| **ICU stay** | **hour** | 39.9 ± 43.7 | 27.6 ± 15.0 | *0.039* |
| **Length of hospital stay**  | **day** | 10.1 ± 3.8 | 9.3 ± 4.4 | *0.384* |
| **Calculated cost of hospital stays** | **Baht**  | 13,540 ± 6,355 | 11,264 ± 5,229 | *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 was varied as age range and health background of study population and diagnostic criteria of each research.(6,7,10,11) 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 comparing with patients who do 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.(12)Despite formal neuropsychological test may be effective in diagnosing mild cognitive 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 for long-term outcome would be more benefit. Controlling anesthetic regimen and targeted sedation protocol in ICU and 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.

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**อิทธิพลของ****ภาวะการสูญเสียหน้าที่ด้านการรับรู้การเข้าใจก่อนผ่าตัดต่อผลการรักษาในผู้ป่วยผ่าตัดหัวใจ**

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**บทนำ** ปัจจุบันยังไม่มีหลักฐานแน่ชัดว่าการสูญเสียหน้าที่ด้านการรับรู้การเข้าใจก่อนผ่าตัดเป็นปัจจัยเสี่ยงที่ส่งผลอันไม่พึงประสงค์ต่อการผ่าตัดหัวใจ วัตถุประสงค์ของการศึกษานี้เพื่อดูอิทธิพลของภาวะการสูญเสียหน้าที่ด้านการรับรู้การเข้าใจก่อนผ่าตัดต่อผลการรักษาในผู้ป่วยผ่าตัดหัวใจ

**วิธีการศึกษา** ผู้ป่วยที่เข้ารับการผ่าตัดหัวใจที่โรงพยาบาลจุฬาลงกรณ์จำนวน100 คนจะได้รับการประเมินหน้าที่ด้านการรับรู้การเข้าใจก่อนผ่าตัดโดยใช้ Montreal Cognitive Assessment (MoCA) ก่อนการผ่าตัด หากมีคะแนนน้อยกว่า 26 คะแนนจะถือว่ามีการสูญเสียหน้าที่ด้านการรับรู้การเข้าใจ โดยแบ่งผู้ป่วยออกเป็นกลุ่มที่มีและไม่มีการสูญเสียหน้าที่ด้านการรับรู้การเข้าใจ จากนั้นจะประเมินผลอันไม่พึงประสงค์จากการผ่าตัดหัวใจ

**ผลการศึกษา** ผู้ป่วยหนึ่งคนถอนตัวออกจากการศึกษาและพบว่าผู้ป่วย 69 คนจาก 99 คน (68.1%) มีภาวะการสูญเสียหน้าที่ด้านการรับรู้การเข้าใจก่อนการผ่าตัด ซึ่งผู้ป่วยในกลุ่มนี้เมื่อเทียวกับกลุ่มที่ไม่มีภาวะดังกล่าวพบว่าใช้เครื่องช่วยหายใจนานกว่า (15.9±26.6 VS 7.4+8.76 hrs., p =0.018) ระยะเวลาที่อยู่ในหออภิบาลผู้ป่วยหนักมากกว่า (39.9±43.7 VS 27.6±15.0 ชั่วโมง, p= 0.039) และมีค่าใช้จ่ายในการอยู่โรงพยาบาลสูงกว่า (13,540±6,355 VS 11,264 ± 5,229 บาท, p=0.014) แต่ไม่พบความแตกต่างของระยะเวลาที่อยู่ในโรงพยาบาลของทั้งสองกลุ่ม(10.1±3.8 VS 9.3±4.4 วัน, p = .384)

**สรุป** จากการศึกษาพบว่าภาวะการสูญเสียหน้าที่ด้านการรับรู้การเข้าใจก่อนการผ่าตัดส่งผลอันไม่พึงประสงค์ต่อผู้ป่วยที่เข้ารับการผ่าตัดหัวใจ ซึ่งอาจมีประโยชน์ที่จะใช้จัดลำดับความเสี่ยงในการคัดกรองคนไข้ก่อนเข้ารับการผ่าตัดเพื่อลดความเสี่ยงและทำให้ผลการรักษาดีขึ้น