

Neurocognitive Disorders in Coronarian Surgery and Place of the Mini Mental State Examination (MMSE)



Sandra Ait Aoudia*

Central Army Hospital, Africa

Submission: September 23, 2017; **Published:** December 13, 2017

***Corresponding author:** Sandra Ait Aoudia, Medical ICU, Central Army Hospital, Algeria, Africa, Email: sandrait2004@hotmail.com

Abstract

Introduction: Neurocognitive disorders after cardiac surgery are frequent and variable in their expression. In addition to perioperative stroke, cognitive impairment occurs in 30-70% of cases, most often functional and transient. They are detected on the clinic and by specific neuropsychic tests.

Patients and methods: Prospective study, including 37 patients operated on by coronary artery bypass graft surgery. The Mini Mental State Examination (MMSE) exploring cognitive functions was performed pre- and postoperatively (J3 post-op). The loss of 2 points or more suggests a neurocognitive disorder.

Results: Average age of our patients is 63 years \pm 7.39 [44-74 years] with a sex ratio of 4.28 (30M/07W), post-operative: Calm awakening found in 67.56 % of our patients, agitation in 24.32%, temporo-spatial disorientation in 5.40% and ischemic stroke in 5.40% of patients.

Results of the MMSE: There are, memory impairment in 19 patients, calculation-Caution: 14 patients, orientation (time-space): 07 patients and praxia in 03 patients.

Discussion: The most affected population of neurocognitive disorders is in patients of advanced age (>60 years), stroke is found in 5.4% of cases and neurocognitive disorders in 57.57%, the most cognitive function often affected is memory. The factors favoring the onset of neurocognitive disorders are: Advanced age and duration of aortic clamping. The origin of neurocognitive disorders after coronary artery bypass graft surgery is multifactorial. In addition to patient-related factors, there are factors related to CEC and surgical procedure.

Conclusion: Neurocognitive complications after coronary artery surgery remain a worrying problem that could be aggravated given the increasing age of patients and the greater number of associated pathologies. The search for cognitive impairment should be an integral part of the pre- and post-operative evaluation of cardiac surgery patients. The Mini Mental State Examination (MMSE) would represent "the thermometer of cognitive function".

Keywords: Coronary Surgery; Neurocognitive Disorders; Mini Mental State Examination; Extracorporeal Circulation

Introduction

Neurocognitive disorders are the most frequent complication in cardiac surgery with extracorporeal circulation (CEC) [1]. Their incidence varies from 30 to 70% according to the studies [2-6]. The existence of these postoperative neurocognitive dysfunctions has been a phenomenon known for many years, and so many studies have focused on perioperative periods of cardiac and vascular surgery. However, these dysfunctions have also been described during noncardiac surgeries and minor surgeries [7].

Progress in both anesthesia and surgery and CEC procedures has been accompanied by a reduction in morbidity and mortality that pushes age limits. Elderly patients with multiple pathologies benefiting more and more frequently from this type of surgery are the preferred target of postoperative neurocognitive disorders, the clinical consequences of which in terms of morbidity, mortality,

postoperative rehabilitation [8] and the implications are far from negligible [3].

Morbidity and mortality in cardiac surgery is established through recognized specific scores such as Euroscore or Parsonnet score where only stroke, widely studied in cardiac surgery, is clearly taken into account as a postoperative neurological complication.

Roach divided into 2 groups the neurological manifestations occurring after cardiac surgery:

- I. Type I: includes stroke, TIA (Transient Ischemic Attack) and Comas. These are disorders of consciousness related to focal ischaemias of the cerebral parenchyma. Their incidence varies between 1.5 and 5.2% [9].

II. Type II: Represented by neuropsychological or cognitive dysfunctions (confusion, agitation, disorientation, memory disorders), found in 30 to 70% of the patients operated in cardiac surgery [10]. They are, in most cases, functional and transitory; without detectable organic lesion, detected on the clinic and by specific neuropsychic tests.

Mini Mental State Examination (MMSE)

Accurately encrypting the incidence of postoperative cognitive dysfunction requires the use of easy-to-use, sensitive and specific diagnostic tools. Many cognitive assessment tests have been proposed to detect early symptoms reliably and reliably. For

example, the Mini Mental State Examination (MMSE) has been validated specifically for the detection of major disorders of major cognitive functions (orientation, registration, attention and calculation, memory, language and praxis) after cardiac surgery. Established in 1975 by Folstein [11], it is an instrument for assessing the cognitive functions developed for rapid screening. Its ease of use, speed of execution (5-10mns) as well as the extensive functions explored quickly imposed it amongst the brief evaluation instruments of functions worldwide.

Some authors suggest discussing cognitive function monitoring rather than establishing arbitrary criteria for cognitive dysfunction [12] (Figure 1).

Mini-Mental State Examination (MMSE)

Patient's Name: _____ Date: _____

Instructions: Score one point for each correct response within each question or activity.

Maximum Score	Patient's Score	Questions
5		"What is the year? Season? Date? Day? Month?"
5		"Where are we now? State? County? Town/City? Hospital? Floor?"
3		The examiner names three unrelated objects clearly and slowly, then the instructor asks the patient to name all three of them. The patient's response is used for scoring. The examiner repeats them until patient learns all of them, if possible.
5		"I would like you to count backward from 100 by sevens." (93, 86, 79, 72, 65, ...) Alternative: "Spell WORLD backwards." (D-L-R-O-W)
3		"Earlier I told you the names of three things. Can you tell me what those were?"
2		Show the patient two simple objects, such as a wristwatch and a pencil, and ask the patient to name them.
1		"Repeat the phrase: 'No ifs, ands, or buts.'"
3		"Take the paper in your right hand, fold it in half, and put it on the floor." (The examiner gives the patient a piece of blank paper.)
1		"Please read this and do what it says." (Written instruction is "Close your eyes.")
1		"Make up and write a sentence about anything." (This sentence must contain a noun and a verb.)
1		"Please copy this picture." (The examiner gives the patient a blank piece of paper and asks him/her to draw the symbol below. All 10 angles must be present and two must intersect.)
30		TOTAL

Instructions for administration and scoring of the MMSE

Orientation (10 points):

- Ask for the date. Then specifically ask for parts omitted (e.g., "Can you also tell me what season it is?"). One point for each correct answer.
- Ask in turn, "Can you tell me the name of this hospital (town, county, etc.?)?" One point for each correct answer.

Registration (3 points):

- Say the names of three unrelated objects clearly and slowly, allowing approximately one second for each. After you have said all three, ask the patient to repeat them. The number of objects the patient names correctly upon the first repetition determines the score (0-3). If the patient does not repeat all three objects the first time, continue saying the names until the patient is able to repeat all three items, up to six trials. Record the number of trials it takes for the patient to learn the words. If the patient does not eventually learn all three, recall cannot be meaningfully tested.
- After completing this task, tell the patient, "Try to remember the words, as I will ask for them in a little while."

Attention and Calculation (5 points):

- Ask the patient to begin with 100 and count backward by sevens. Stop after five subtractions (93, 86, 79, 72, 65). Score the total number of correct answers.
- If the patient cannot or will not perform the subtraction task, ask the patient to spell the word "world" backwards. The score is the number of letters in correct order (e.g., dlow=5, dlow=3).

Recall (3 points):

- Ask the patient if he or she can recall the three words you previously asked him or her to remember. Score the total number of correct answers (0-3).

Language and Praxis (7 points):

- Naming:** Show the patient a wrist watch and ask the patient what it is. Repeat with a pencil. Score one point for each correct naming (0-2).
- Repetition:** Ask the patient to repeat the sentence after you ("No ifs, ands, or buts."). Allow only one trial. Score 0 or 1.
- 3-Stage Command:** Give the patient a piece of blank paper and say, "Take this paper in your right hand, fold it in half, and put it on the floor." Score one point for each part of the command correctly executed.
- Reading:** On a blank piece of paper print the sentence, "Close your eyes," in letters large enough for the patient to see clearly. Ask the patient to read the sentence and do what it says. Score one point only if the patient actually closes his or her eyes. This is not a test of memory, so you may prompt the patient to "do what it says" after the patient reads the sentence.
- Writing:** Give the patient a blank piece of paper and ask him or her to write a sentence for you. Do not dictate a sentence; it should be written spontaneously. The sentence must contain a subject and a verb and make sense. Correct grammar and punctuation are not necessary.
- Copying:** Show the patient the picture of two intersecting pentagons and ask the patient to copy the figure exactly as it is. All ten angles must be present and two must intersect to score one point. Ignore tremor and rotation.

Figure 1: We can see the transverse process and the three muscle layers. Local anesthetic spreading above and below the ESP.

Patients and Methods

Our study included 37 adult patients operated for aorto-coronary bypass surgery. The exclusion criteria were: Combined surgery (valve, carotid); neurological history (stroke, transient ischemic cerebral accident, epilepsy, Parkinson ...); Surgery with heart beating and patients intubated more than 24h in post-operative.

The anesthetic protocol involved induction a classical sequence associating hypnovel/etomidate or propofol, sufentanil, rocuronium. The maintenance was provided by isoflurane and/or a continuous infusion of propofol associated with a continuous infusion of sufentanil. Patients were all admitted to the intensive care unit where they received sedation a few hours before waking and extubation. The evaluation of pre- and post-operative cognitive functions involved the Mini Mental State Examination.

The test consisted of a series of questions grouped into seven categories. These questions included: orientation in time (5 points), orientation in space (5 points), immediate recall of three words (3 points), attention (5 points), delayed recall three words (3 points), language (8 points) and constructive praxis (1 point). The maximum possible score was therefore 30 points [8]. Patients were evaluated on the day before surgery and on the third postoperative day. The pre- and postoperative examiner was the same.

The statistical study carried out by Epi info 7 logical. The quantitative variables are expressed as mean +/- standard deviations and compared using a reduced deviation test and the qualitative variables are expressed in absolute values and in percentages; the comparisons use the chi-square test. The significance threshold is defined as p <0.05.

Results

The 37 patients operated for coronary surgery had an average age of 63.46 ± 7.39 (range: 44 and 74 years), a sex ratio of 4.28 (30H/07F). More than half of our patients were obese

with a history of hypertension, angina, dyslipidemia and diabetes (Figure 2). For preoperative therapy, antiplatelet agents are found in all our patients, Conversion enzyme inhibitors and β blockers in more than 80% of our patients (Figure 3).

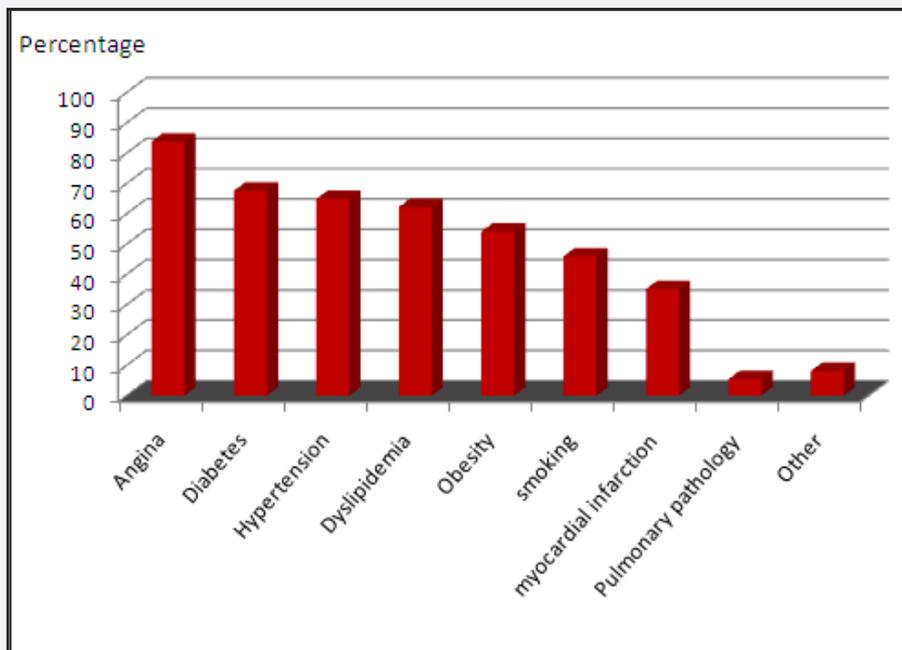


Figure 2 : Medical history and risk factors.

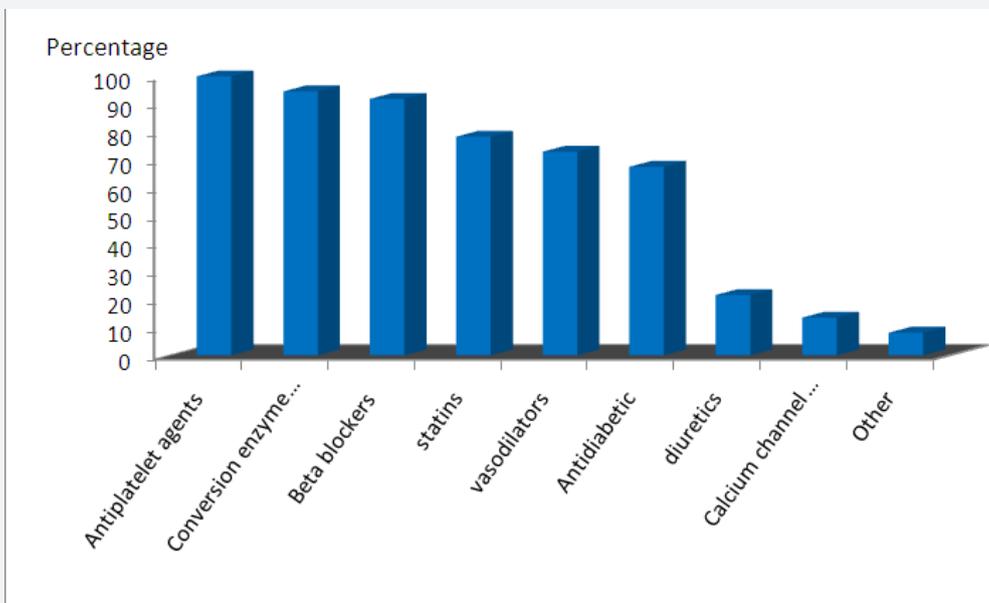


Figure 3 : Preoperative Therapeutics.

Of the 37 patients operated on for coronary surgery, only 33 patients were selected for our study, as 02 patients required a ventilation time of > 24 h and 02 patients were never extubated (Table 1).

A postoperative decrease in the MMSE test was two or more points in 19 patients (57.57%). The decline in performance affected all items (Table 2). These patients were older (66.89 ± 6.64 years) with the mean duration of longer aortic clamping (98.72 ± 31.72 mn) (Table 3).

Table 1: Post-operative period.

➤ All our patients (37 patients) were admitted to the Intensive Care Unit, intubated, ventilated and sedated for a few hours, with a monitoring of the various parameters (Hemodynamic, Respiratory, and Biological).
➤ Post-operative wake-up:
- Calm: 25 patients (67.56%)
- Agitation: 09 patients (24.32%)
- Disorientation: 02 patients (05.40%)
- Presence of motor deficit: 02 patients (05.40%) revealing ischemic cerebral vascular accident (CT scans).
➤ Extubation: (H: Hour)
- ≤ H8 postoperative: 09 patients (24.32%)
- H8-H12 postoperative: 13 patients (35.13%)
- H12-H24 Post-operative: 11 patients (29.73%)
- H24 postoperative: 02 patients (5.40%)
02 patients (5.40%) were never extubated because they died (Low cardiac output, multivisceral defects syndrome).

Table 2: Results of the MMSE.

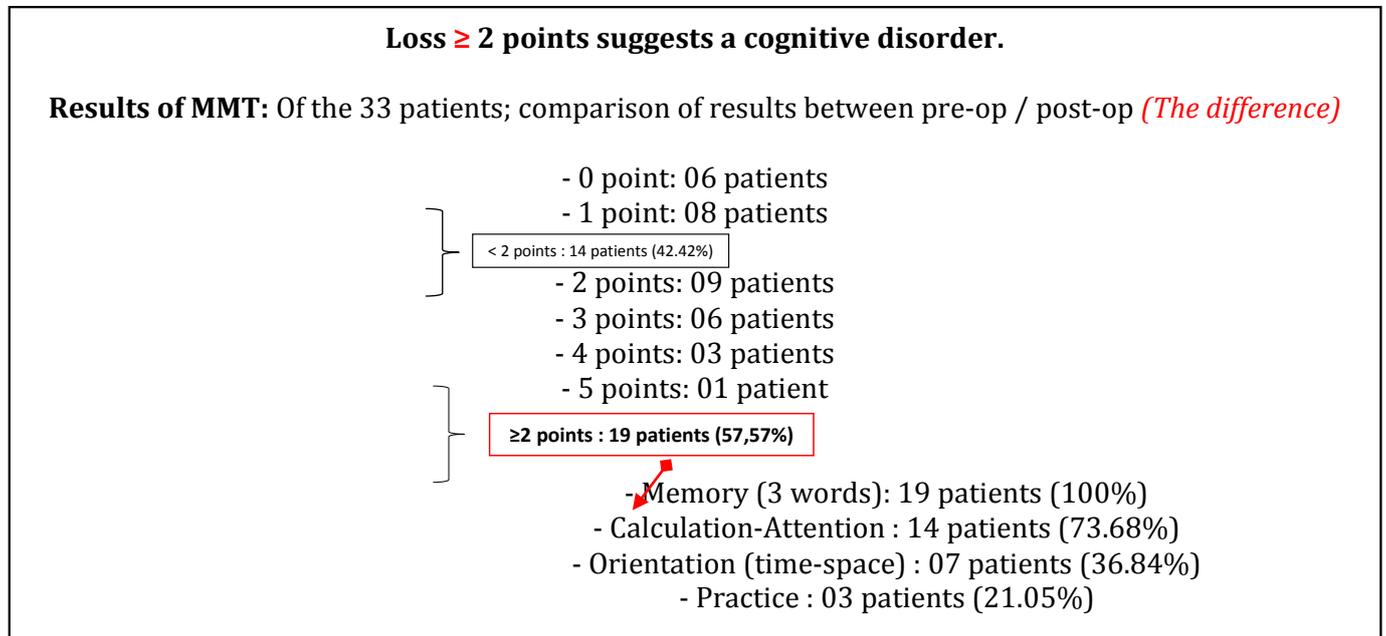


Table 3: Analysis of risk factors.

	< 2 points (14 patients)	≥ 2 points (19 patients)	p
Age (year)	58.85±6.98 [46-70]	66.89±6.64 [50-74]	0.001
Female	02 (14.28%)	04 (21.05%)	Ns
Smoking (Tobacco)	08 (57.14%)	08 (42.10%)	Ns
HTA	08 (57.14%)	13 (68.42%)	Ns
Diabetes	10 (71.42%)	12 (63.15%)	Ns
Angina	12 (85.71%)	15 (78.94%)	Ns
IDM	04 (28.57%)	05 (26.31%)	Ns
Dyslipidaemia	09 (64.28%)	11 (57.89%)	Ns
Obesity	06 (42.85%)	12 (63.15%)	Ns
Duration of ECC (min)	119.21 ± 41.35 [50-203]	139.93 ± 39.35 [48-201]	Ns
Duration of aortic clamping (min)	76.64 ± 29.43 [32-142]	98,72 ± 31.72 [38-148]	0.04
Temperature during ECC (°C)	34.04 ± 0.92 [32.4-36]	33.45 ± 0.27 [33.1-34]	Ns

Vasoactive Drugs	06 (42.85%)	13 (68.42%)	Ns
Postoperative hematocrit (%)	29.42 ± 2.79 [24-34]	28.88 ± 3.51 [23-36]	Ns

ECC: Extracorporeal circulation.

Ns: Not significant

Discussion

Cardiac surgery (valvular or coronary) is a well documented risk factor for postoperative cognitive disorders [3]. The most affected population concerns the oldest patients, benefiting from the longest ECC. These data corroborate those of the literature in this field [5,6,13]. The embolic mechanism is considered to be the main provider of neurocognitive disorders during this surgery, whereas cerebral hypoperfusion, in particular per-CEC, or inflammation, probably play only a minor role. Microembolus less than 40 µ in diameter composed of platelets, leukocyte clusters, air, fat and particles from the CEC circuit [14-16] would disrupt self-regulation of cerebral blood flow, making it more sensitive to changes in mean arterial pressure [17]. These debris would be released at the time of aortic cannulation, clamping and clamping, proximal suture of the venous graft and at each aortic manipulation. These microemboli are easily visualized by the transcranial doppler [15].

These phenomena of microembolism would be more important in the case of valvular surgery than coronary surgery [5]. The aggravating role of too rapid warming after hypothermic CEC and postoperative hyperthermia has been well documented. Recent evidence suggests, however, that inflammation may favor deterioration of cognitive performance after coronary bypass surgery [18].

In cardiac surgery where the embolic mechanism remains predominant, materials to reduce the occurrence of intraoperative stroke (arterial filters) have proved to be ineffective. On the other hand, a not too rapid warming during the use of a normothermic CEC, the postoperative temperature control with the systematic use of antipyretics, the immediate treatment or even the prevention of episodes of complete arrhythmia by atrial fibrillation are all recommendations that can be formulated [19].

For appropriate management of these patients, it is interesting to create networks of care in partnership with neuropsychologists, which will enable the development of therapeutic strategies for the management of these patients. It would be useful to create protocols to detect these perioperative cognitive disorders (evaluation) and to propose a treatment regimen according to the symptoms described.

Conclusion

While improvements in the morbidity and mortality of cardiac surgery patients have been achieved through improved surgical, anesthetic and resuscitation techniques, it remains that 30% to 80% of these patients capable of developing neurocognitive disorders that are mostly functional, transient and of variable

cause. These dysfunctions can sometimes persist for months, even years and seem to be a factor of comorbidity. Postoperative cognitive decline is associated with decreased quality of life for patients and significant social and financial implications for these patients and their families. It is important to be able to assess the baseline cognitive status of these patients before surgery. An easy-to-use, rapid, reproducible, and readily available scale in patients' beds seems to us to be a wise option to allow for a rapid, albeit rough, assessment of the cognitive status of these patients. Prevention of post-operative cognitive impairment requires the identification of individuals at risk and must be one of the objectives of anesthesia consultation.

In total, the Mini Mental State Examination (MMSE) is a practical tool for screening and clinical follow-up of the cognitive state of patients by the clinician. Its simple use makes it a test that deserves to be included in the systematic review of patients operated in cardiac surgery. It is, however, only a test for cognitive impairment.

References

- Blackstone EH (2000) Neurologic injury from cardiac surgery-an important but enormously complex phenomenon. *J Thorac Cardiovasc Surg* 120: 629-631.
- Ahonen J, Salmenperä M (2004) Brain injury after adult cardiac surgery *Acta Anaesthesiol Scand* 48(1): 4-19.
- Newman MF, Grocott HP, Mathew JP, White WD, Landolfo K, et al. (2001) Report of the substudy assessing the impact of neurocognitive function quality of life 5 years after cardiac surgery. *Stroke* 32(12): 2874-2881.
- Van Dijk D, Keizer AMA, Diephuis JC, Durand C, Vos LJ, et al. (2000) Neurocognitive dysfunction after coronary artery bypass surgery: a systematic review. *J Thorac Cardiovasc Surg* 120(4): 632-639.
- Ebert AD, Walzen TA, Huth C, Hermann M (2001) Early neuronal disorders after cardiac surgery: a comparative analysis of coronary artery bypass graft surgery and valve replacement. *J Cardiothorac Vasc Anesth* 15: 15-19.
- Arrowsmith JE, Grocott HP, Newman MF (1999) Neurologic risk assessment, monitoring and outcome in cardiac surgery. *J Cardiothorac Vasc Anesth* 13(6): 736-743.
- Moller JT, Cluitmans P, Rasmussen LS, Houx P, Rasmussen H, et al. (1998) Long term postoperative cognitive dysfunction in the elderly ISPOCD1 study. ISPOCD investigators international study of postoperative cognitive dysfunction. *Lancet* 351(9106): 857-861.
- Ahlgren E, Lundqvist A, Nordlund A, Aren C, Rutberg H (2003) Neurocognitive impairment and driving performance after coronary artery bypass surgery. *Eur J Cardiothorac Surg* 23(3): 334-401.
- Selnes OA, Mc Khann GM (2005) Neurocognitive complications after coronary bypass surgery. *Ann Neurol* 57(5): 615-621.
- Weissrock S, Levy F, Balabaud V, Thiranos JC, Dupeyron JP, et al. (2005) Interest of the mini mental state examination to detect cognitive defects after cardiac surgery. *Ann Fr Anesth Reanimation* 24(10): 1255-1261.

11. Folstein MF, Folstein SE, McHugh PR (1975) Mini-Mental State. A practical method for grading the cognitive state of patients for the clinician. *J Psychiat Res* 12(3): 189-198.
12. Newman S, Stygall J, Hirani S, Shaefi S, Maze M (2007) Postoperative cognitive dysfunction after non cardiac surgery: a systematic review. *Anesthesiology* 106(3): 572-590.
13. Andrew MJ, Baker RA, Bennetts J, Kneebone AC, Knight JL (2001) A comparison of neuropsychologic deficits after extracardiac and intracardiac surgery. *J Cardiothorac Vasc Anesth* 15(1): 9-14.
14. Nussmeier NA (2002) A review of risk factors for adverse neurologic outcome after cardiac surgery. *J Extra Corpor Technol* 34(1): 4-10.
15. Clark RE, Brillman J, Davis DA, Lovell MR, Price TR, et al. (1995) Microemboli during coronary artery bypass grafting. Genesis and effect on outcome. *J Thorac Cardiovasc Surg* 109(2): 249-257.
16. Roach GW, Kanchuger M, Mangano CM, Newman M, Nussmeier N, et al. (1996) Adverse cerebral outcomes after coronary bypass surgery. Multicenter Study of Perioperative Ischemia Research Group and the Ischemia Research and Education Foundation Investigators. *N Engl J Med* 335(25): 1857-1863.
17. Newman MF, Croughwell ND, Blumenthal JA, White WD, Lewis JB, et al. (1994) Effect of aging on cerebral autoregulation during cardiopulmonary bypass. Association with postoperative cognitive dysfunction. *Circulation* 90: 243-249.
18. Kalman J, Bogats G, Babik B, Rimanoczy A, Janka Z, et al. (2006) Elevated levels of inflammatory biomarkers in the cerebrospinal fluid after coronary artery bypass surgery are predictors of cognitive decline. *Neurochem Int* 48(3): 177-180.
19. Grigore AM, Grocott HP, Mathew JP, Phillips-Bute B, Stanley TO, et al. (2002) The rewarming rate and increased peak temperature alter neurocognitive outcome after cardiac surgery. *Anesth Analg* 94(1): 4-10.



This work is licensed under Creative Commons Attribution 4.0 License
DOI: [10.19080/JAICM.2017.04.555647](https://doi.org/10.19080/JAICM.2017.04.555647)

Your next submission with Juniper Publishers will reach you the below assets

- Quality Editorial service
- Swift Peer Review
- Reprints availability
- E-prints Service
- Manuscript Podcast for convenient understanding
- Global attainment for your research
- Manuscript accessibility in different formats
(Pdf, E-pub, Full Text, Audio)
- Unceasing customer service

Track the below URL for one-step submission
<https://juniperpublishers.com/online-submission.php>