Reviewer's report

Title: Cerebral oxygen saturation during off-pump coronary artery bypass grafting in patients with carotid artery stenosis: a retrospective review

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Reviewer: Stefano Romagnoli

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Dear Editor,

thank you for the opportunity to review the paper entitled “Cerebral oxygen saturation during off-pump coronary artery bypass grafting in patients with carotid artery stenosis: a retrospective review” by Toyama and collaborators.

The study deals with the role of cerebral saturation monitoring (rSO2) during OPCAB in patients with and without carotid artery stenosis.

It is my opinion that the study has several important problems and major concerns arise due to several conceptual and technical imprecisions. These points are itemized below.

Major concerns

Summary - method
- The method used for CI estimation should be indicated (PAC – Thd)
- The number of patients included in the analysis should be indicated in the “results” section.

Summary – results:
- The degree of the stenosis MUST be indicated in the summary.
- The values of blood pressure during the most challenging phases (e.g. marginal, posterior revascularization) has to be considered in the results. Blood pressure could as important as blood flow in decreasing tissue oxygen saturation.

General comments (major):
- the author stated that: “… NIRS devices assume that the hemoglobin content of the cerebral cortex is distributed 75% in the venous and 25% in the arterial district …” … and this is true… In fact, a reduction in rSO2 can derive from a reduction in arterial supply (as occurs during OPCAB), a decrease in venous drainage (as also occurs during OPCAB), or a combination of them (as clearly occurs during OPCAB) … For example, a patients with cardiac tamponade may has a still good “antegrade-arterial” flow with acceptable perfusion but limited venous drainage with consequent venous congestion. This condition may be associated with reduction in rSO2…. this aspect should be considered in the discussion. In addition, in order to identify any possible correlation between
venous congestion and drop in rSO2, central venous pressure values should be considered. It is my opinion that a graph showing the relationship between CVP and sSO2 could be important.

- When “aortic no-touch technique” is used, major hemodynamic instability do not occur during revascularization. Moreover, venous congestion, due to heart dislocation, do not occur. This sub-group of patients should be separated from the others.

- The use of the “pulmonary artery catheter“ is almost unusual in modern NON-combined cardiac surgery (e.g. CABG or OPCAB). Please provide a comment.

- In many cardiac centers, carotid and coronary artery revascularization are performed during the same intervention in order to limit the neurological consequences due to hemodynamic instability. Please, provide a comment on this.

- Page 10 – line 9: “3 patients received carotid artery stenting prior to CABG”. Did you include these patients into the group with stenosis? Please specify.

- Page 10 – lines 11-12: “Aortic not-touch technique was used more frequently in the stenosis group than the normal group (p = 0.026).” Please provide the numbers a see the comment above.

- The technique used for CI estimation must be described. Moreover, thermodilution is imprecise in presence of tricuspid regurgitation (TR) and cannot be used for flow calculation. How did the authors exclude TR during ALL the phases of surgery? Once the heart is dislocated to perform posterior and lateral anastomosis, TEE cannot be used because the contact between the esophagus and the pericardium is interrupted by air. Please provide a comment.

- Neurological outcome of the studied patients should be highlighted.

Page 8 – lines 7-8: “The rSO2 values from the right and left frontal lobes were averaged to represent regional cerebral oxygenation.” In case of stenosis of a single carotid artery (more common condition) and without a good compensation of the intracerebral circulation, a major desaturation of a single side would be expected. Since the authors did the average of the two sides, a comment on this could be useful for the reader.

Page 8 – lines 10-12: “a decrease in rSO2 > 20% from baseline value indicates a critical reduction in cerebral oxygenation and perfusion” ... (AGAIN) a reduction in rSO2 can derive from a reduction in arterial supply (as may occur during OPCAB), a decrease in venous drainage (as usually occurs during OPCAB), or a combination of them (as clearly occurs during OPCAB) ... For example, a patients with cardiac tamponade may have a still good “antegrade” flow with acceptable perfusion but limited venous drainage with consequent venous congestion. This condition may be associated with reduction in rSO2.... this aspect should be considered in the discussion. In addition, in order to identify any possible correlation between venous congestion and drop in rSO2, central venous pressure values should be considered. It is my opinion that a graph showing the relationship between CVP and sSO2 could be important.
Page 10 – lines 4-7: “In the stenosis group, 4 patients had a unilateral high-grade (>70%) CAS, 1 patient had a unilateral high-grade (>70%) CAS with a contralateral occlusion, 4 patients had bilateral high-grade CAS and 2 patients had bilateral moderate-grade (>50%) CAS”. The CAS group shows a very high heterogeneity. A stenosis > 70% may have, depending on adopted guidelines and recommendations (and the presence or absence of symptoms) surgical indication while 50-60 usually not. This variability is a strong limitation of the study and need a dedicated comment.

Page 12 – line 8: “and ETCO2 was maintained between 35 and 40”. ET CO2 depends on several factors including: minute ventilation, CO2 production and flow to the pulmonary system (cardiac output). Right ventricular stroke volume usually drop during OPCAB due to the heart dislocation and handling. In light of this observation, the sentence is not correct since CO2, as indicated in the text, is considered as regulator of cerebral blood flow but, in this case, a profound difference between PCO2 and ETCO2 may exist.

Page 12 – line 1-2: “In the present study, cerebral oxygenation significantly decreased during anastomosis in both the stenosis and normal groups.” I strongly disagree with this statement. rSO2 significantly decreased but not necessarily “cerebral oxygenation” decreased. In fact, as considered before, a reduction in rSO2 may result from an INCREASE in venous congestion rather than a decrease in arterial blood flow. The data has to be correlated with CVP. Probably, this is the reason that may explain that “However, the decrease in cerebral oxygenation during anastomosis was not statistically significant between the two groups.”

Minor concerns

Page 4 –line 5: “CPB, such” – space

Page 4 –line 7: replace “chronic kidney injury” with “chronic kidney disease”. Injury is mostly referred to an acute syndrome

Page 4 –line 7: “caused” – check

Page 4 – lines 13-16: “Since decreased cerebral perfusion pressure (CPP) due to CAS caused a decrease in cerebral blood flow (CBF) depending on the degree of the stenosis [19], CAS can provoke cerebral hypoperfusion to cause cerebral ischemia when hemodynamic impairment occurs during surgery.” – The sentence is difficult to read. Please re-phrase.

Page 6 – line 4: “Teikyo University Chiba Medical Center” … add the Country

Page 6 – line 4: replace “to” with “into”

Page 12 – lines 11-12: “It is unclear whether CAS is associated with an increased risk of cerebral ischemia during off-pump CABG.” A ref is needed.

Page 14 – line 25: “However, studies showing the incidence of strokes in patients with CAS after…” A ref is needed.

Level of interest: An article of insufficient interest to warrant publication in a
scientific/medical journal

Quality of written English: Acceptable

Statistical review: No, the manuscript does not need to be seen by a statistician.

Declaration of competing interests:
I declare that I have no competing interests