Reviewer’s report

Title: Evaluation of Coronary Blood Flow during Cardiac Arrest with Circulation Maintained through Mechanical Chest Compressions in a Porcine Model

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Reviewer: John Bro Bro-Jeppesen

Reviewer’s report:

I think this is an interesting report evaluating the coronary hemodynamic in a porcine model of cardiac arrest during mechanical chest compressions. The model is useful and a lot of work has been carried out to perform this set-up. Even if not perfect, it might be of value for being published with some major revisions, but some points need to be further clarified.

- Major Compulsory Revisions

The author must respond to these before a decision on publication can be reached. For example, additional necessary experiments or controls, statistical mistakes, errors in interpretation.

1:
Methods, ventilator settings and instrumentation, last paragraph.
Please explain the term “arbitrary units” for measuring coronary flow. The measurement of average peak velocity (APV) should be further described, is it the average of a number of peak velocities? Calculation of APV should be further described.

2:
Methods, experimental protocol.
I would appreciate more detailed information regarding the ventilator settings during the intervention.
- Was ventilation discontinued during the period of ventricular fibrillation?
- During mechanical chest compressions?
- After restoring spontaneously circulation? Was 100 % oxygen administered?

3:
Methods, measurements, Figure 1.
The Doppler signal at baseline is fine, diastolic flow and no artefacts. During mechanical chest compressions the ECG signal is hard to see, does not look like ventricular fibrillation, more like movements artefacts from the mechanical compression device.
My concern is the Doppler curve under mechanical chest compressions. How can the reader be convinced that the Doppler signals is not due to motion artefacts from chest compressions and does in fact represent coronary flow in the LAD. Please comment on the very high initial peak velocity during chest compressions compared to baseline. Please comment on the phase of compression in which the flow appears. This is important for evaluating the use of your method, especially in regard of peak velocities as a marker for coronary flow.

Furthermore: Much emphasis is put on the correlation on TIMI flow and APV in these models. From the methods section it can be appreciated that a guiding catheter was in place (or even wedged) during the VF phase. Were no angiograms performed and if there were, did the authors find any correlation between the finding and the APV or CPP?

4:
Results, table 1.
The unit for APV has changed from cm/s to ml/min, please explain this. Have you measured the diameter of the LAD for this calculation and how.

5:
Results, second paragraph.
Doppler flow curves in the coronary artery (LAD) at baseline and during mechanical chest compressions were obtained with some technical challenges. Doppler coronary flow could not be obtained during sinus rhythm after restoring circulation. This must be mentioned in the discussion. It appears to be contradictory to what would be expected that measurements were possible during mechanical compression and at baseline, but not at all during the 15 minutes of post-ROSC observation. This should be commented in detail.

The impact of hyperaemia in the ROSC phase did interfere with the Doppler curves, but hyperaemia in the fase with mechanical chest compressions did only have little influence. This discrepancy should be commented in the discussion and the impact of boluses of epinephrine during defibrillation should be discussed

6:
Results, Figure 2.
Information regarding the amount of data must be added in the figure legend. Is the data from one pig or a mean of all sampled data from 10 pigs. The figure seems quite “smooth”. It looks like all the 8 pigs had ROSC within the same minute after defibrillation, which I imagine would not be the case.

7:
Results.
Information about number of defibrillations is missing. Please mention how many
times defibrillation was preformed, dose of adrenaline administered during resuscitation. Mean time for restoring circulation would also be important.

8:
Results, second last paragraph.
The correlation between CPP and APV during chest compressions is clear, but the authors should comment on the differences in the measurements at baseline, why are there no agreement between the two methods. As data after restoring circulation is missing too, it is hard to be convinced that the Doppler method is capable of measuring real coronary blood flow.

9:
Conclusion.
Your conclusion “that mechanical chest compressions can, at minimum, reestablish coronary blood flow in non-diseased coronary arteries during cardiac arrest” could be modified. Only if the flow wire is indeed able to show flow during mechanical compression this would be case, but other than the CPP there is no evidence presented to support this.

- Minor Essential Revisions
The author can be trusted to make these. For example, missing labels on figures, the wrong use of a term, spelling mistakes.

- Discretionary Revisions
These are recommendations for improvement which the author can choose to ignore. For example clarifications, data that would be useful but not essential.

1:
Results, table 2.
Does not add further information, can be omitted.

2:
Results, last paragraph.
Could you revise this paragraph to clarify whenever the differences mentioned are between the two time periods or differences from normal values.

3:
Results, Table 3.
Please comment on the lactate level after 10 min, why is the mean lactate level lower in the venous sample? You may choose to omit the venous blood gases and instead present arterial gases after achieving ROSC if these data are available.
Discussion, third paragraph.

The following sentence needs to be clarified in regard of the relation between CPP and TIMI flow, which has not been documented in the data presented.

“During ongoing mechanical chest compressions, coronary blood flow was actually equal or greater than baseline levels despite cardiac arrest, indicating that a mean CPP was well above 20 mmHg can result in TIMI III flow and that TIMI-flow judgment can be used when assessing the blood flow effects on mechanical chest compressions in the cath-lab.”

**Level of interest:** An article whose findings are important to those with closely related research interests

**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