Title: Perpendicular and turbulent flow after aortic valve replacement: Paravalvular or transvalvular leakage? – A case report

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Version: 1 Date: 06 Dec 2019

Author’s response to reviews:

Reviewer #1: The authors report on a case of unusual turbulent flow in echo after surgical aortic valve replacement.

Although I do think that the case has can be interesting for younger colleagues or students, I do not think that it has enough novelty nor does it provide any new information for the reader.

Response: Thank you for reviewing our manuscript. As you pointed out, this report may not be entirely novel; however, we believe it has educational value especially for fellows and novices in cardiac surgery or cardiothoracic anesthesia.

Another comment I want to make is the fact that for me the title was a little bit provocative as for me the decision for a second pump run would be very clear given the echo loops. This is especially true for AVR in the current era as we as surgeons have to make sure that no patient with a less than perfect result leaves the OR if possible as this is the only argument that we have against the increasing pressure from cardiologists and patients towards TAVI.

Response: The decision for a second pump run may be very clear, judging from echo loops, but cardiac surgeons in our hospital hesitated to use a second pump when we (cardiothoracic anesthesiologists) pointed out the possibility of paravalvular leakage when a perpendicular leak was observed after weaning from CPB. They may have suspected that the leakage was not paravalvular, judging by its flow in the opposite direction in the left ventricular outflow tract perpendicularly. Therefore, it seemed unfamiliar to them. Moreover, in a previous case report, a remarkably large and perpendicular transvalvular leakage was observed by intraoperative transesophageal echocardiography, and this disappeared after the administration of protamine [1]. They may have considered this perpendicular leakage to be similar to that in this previous report. A cardiologist was invited to the operation room and the situation was discussed. Consequently, we decided that there may be two types of perpendicular jets and one of them could be paravalvular leakage. CPB was restarted to repair the paravalvular leakage.
We believe that this case report could be of educational value because without proper orientation not all cardiac surgeons may make a correct and prompt decision when faced with a similar situation.

In addition, according to your comment, we have changed “Observe or repair on extra cardiopulmonary bypass?” to “paravalvular or transvalvular leakage?”


Reviewer #2: The authors present a case of a patient with perpendicular turbulent flow raises the possibility of both TVL and PVL after AVR which originated from the sites near the stent post close to each other. The authors presented that TVL occurred between the stent post and sewing and PVL occurred between sewing ring and native annulus close to TVL in figures and videos. I think the turbulent flows which were showed in figures and videos were same flow. These findings indicates just only presence of PVL which requires reoperation without hesitation. If such a large transvalvular perpendicular flow existed between the stent post and sewing ring, the prosthesis must have had structural injury like perforation or tear in itself. But it was normal. It doesn't make sense. There is nothing special unique.

Response: Thank you for your comment and for taking the time to review our manuscript. Concerning the point you raised - “the turbulent flows which were showed in figures and videos were same flow. These findings indicate just only presence of PVL which requires reoperation without hesitation,” - cardiac surgeons in our hospital hesitated to use a second pump, after we (cardiothoracic anesthesiologists) pointed out the possibility of paravalvular leakage when a perpendicular leak was revealed after weaning from CPB. In addition, there was wide transvalvular leakage in the echo video of the paravalvular leakage in the diastolic phase (Fig. 3). If there was only paravalvular leakage, we would not have observed the transvalvular leakage. Additionally, we would like to submit another TEE image (Fig. 4). In the TEE view, it can be observed that the flow convergence of PVL and TVL comes from the stent post. We could not show the flow convergences of both TVL and PVL in one TEE view plane. This TEE view (Fig. 4. Long-axis view of the midesophageal aortic valve in color compare mode showing the flow convergence of PVL originating from between a pledget and the sewing ring, and TVL from the stent post.) has been added in the manuscript. (Page 6, Line 10)

According to the imaging findings, we concluded that both types of flow existed simultaneously. Additionally, concerning another point you raised - “If such a large transvalvular perpendicular flow existed between the stent post and sewing ring, the prosthesis must have had structural injury like perforation or tear in itself” - a previous case report described a remarkably large and perpendicular transvalvular leakage from the area between the stent post and the sewing ring. This was observed by intraoperative transesophageal echocardiography, but it disappeared after
the administration of protamine [1]. The cardiac surgeons in our institution may have considered this perpendicular leakage to be similar to that in this previous report; therefore, they hesitated to use a second pump.


Reviewer #3: 1. The title is a bit confusing, plz consider rephrasing it.

Response: Thank you for your valuable comment. We have changed “Observe or repair on extra cardiopulmonary bypass?” to “paravalvular or transvalvular leakage?”

2. Plz provide a little more detail of the suturing technique of the re-implantation of the valve.

Response: Thank you once again. We have added an explanation about re-AVR in the manuscript (Page 7, Line 1-5). “The prosthesis was removed by cutting the surgical sutures without dropping the pledgets to the left ventricle, and it was confirmed to be uninjured. Simultaneously, the annulus and pledgets that were sutured to the annulus were checked. AVR was performed with the same prosthesis again in the supra-annular position using the non-evertting mattress suture technique with pledgets, similar to the first AVR.”

3. How long was the total cross clamp (ischemic) time?

Response: The total cross clamp time was 3 hours 16 minutes. First cross clamp time: 1 hours 51 minutes. Second cross clamp time: 1 hour 25 minutes.

Reviewer #4: The paper is of interest in view of the large number of standard, surgical AVR (SAVR) operations being done and the requirement of high standards and benchmarking versus both SAVR and TAVI. PVL is very well known and there are no new information about this in the paper. Regarding TVL this is of interest to document and to elaborate on, also in follow-up. However, in this case the images submitted do not include short-axis views and the perpendicular turbulent flow in the TVL image may be PVL seen simultaneously. It is less likely that a TVL is seen both a central jet as well as a peripheral jet at the same time when there is also an existing relatively large PVL. If a short-axis view and a 3D view present more convincing information this should be taken into consideration.

Response: Thank you for your valuable comment and suggestions. We have responded to the issues you raised in a point-by-point manner below:
1. As it is presented the paper is not convincing according to the aim of presenting perpendicular flow in simultaneous TVL and PVL.

Response: We would like to submit another TEE image, shown in Fig. 4. In the TEE view, TVL can be observed to be coming from the stent post and the flow convergence of PVL. We could not show the flow convergences of both TVL and PVL in one TEE view plane.

2. Short-axis view and 3D should also be submitted.

Response: We regret that we did not record 3D images. We considered that TVL and PVL were in very close proximity to each other near the stent post; therefore, TVL and PVL made one large color flow in the short-axis 2D TEE image with color Doppler (Figure 2). Notwithstanding, we believe that had we provided 3D short-axis views with color Doppler, they would not have provided any more information than that of the 2D TEE image we submitted. If we had shown a clear view of the sewing ring in the long-axis 3D view with color Doppler, we would have distinguished PVL from TVL with the sewing ring at the center; PVL originated from below the sewing ring and TVL originated from above the sewing ring. However, it may be an issue of skill level in performing TEE.

3. The text could be shortened as PVL is well known

Response: According to your suggestion, we have checked our manuscript to shorten it. However, we were unsure about what information to omit. We would like this paper to be interesting and comprehensive not only to professional experienced cardiac surgeons (like the reviewer) but also to younger colleagues (cardiac surgeons and cardiothoracic anesthesiologists) or students. However, if you could point out areas of the text you consider unnecessary, we would very willingly remove them.

Reviewer #5: Very well defined pathology with a nice presentation. I congratulate the authors.

Response: Thank you for your comment. We appreciate your review of our manuscript.

Reviewer #6: First of all, I like to congratulate the authors with such an interesting case. The paper deals with a major problem in valvular surgery. The presented case illustrates the difficulty of differentiating between two causes of prosthetic regurgitation. Transvalvular leak, which in its nature may be beneficial, and provide a "wash down" currents, which may provide additional protection against prosthetic valve thrombosis. Paravalvular leak, on the other hand, is a malignant problem, which needs aggressive management, whether it would be transcatheter or surgical.
However, there are a lot of grammar, and sentence logic errors, which needs to be addressed. I recommend, that prior to publishing this article, the authors should submit the paper for an extensive English language editing.

Best wishes,
Karolis Jonas MD
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Response: Thank you for your thoughtful comment and recommendation. We have consulted a professional English editing company. We believe the language of the manuscript has been improved.