

Peer Review File

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Reviewer A

Comment: The Authors created a catchy and well-written manuscript. The topic is of great interest, but I have only a suggestion. The authors claim that their technique aims to spare cerebral (and other) embolisms. However, to demonstrate this point, the absence of clinical new neurologic defects or symptoms is insufficient to exclude "silent" cerebral embolic damage. It would be methodologically correct to assess basal cerebral anatomy with a brain MR or at least a CT angiography and basal functional status with some neurocognitive test and repeat them after surgery. The absence of such evidence should be discussed as a limitation of the report.

Reply: I fully agree with you. In this case, there were no preoperative neurological deficits observed, and no abnormalities were observed on brain MRI examination prior to the surgery. In addition, extubation was performed on the day of surgery, and no postoperative neurological abnormalities were observed, so further brain imaging was not performed. Nevertheless, as you pointed out, this could be a limitation in that it did not confirm the presence of silent cerebral embolism, and therefore, we will add a description of this point in the manuscript.

Change in the text:

(see Page 3, line 43~45)

“There were no preoperative neurological deficits observed, and no abnormalities were observed on brain magnetic resonance imaging.”

(see Page 3~4, line 63~64)

“Bilateral regional cerebral oxygen saturation values did not drop below 55% during the operation.”

(see Page 5, line 87~89)

“There are several points for discussion including limitations of this study. One of the potential drawbacks of this case is the possibility that asymptomatic cerebral infarction was not detected through postoperative brain imaging.”

Reviewer B

Interesting case.

Comment 1: What was the neurological imaging preoperatively? Was adequate circle of willis flow demonstrated prior to surgery? Did the patient have pre-operative and post-operative brain CT?

Reply: Thank you for your insightful comments. In this particular patient, there were no observed neurological deficits prior to the surgery, and the brain MRI did not indicate any abnormalities, including the circle of Willis. Furthermore, since the patient was extubated on

the same day as the surgery and did not exhibit any neurological abnormalities, there was no need for a postoperative brain imaging evaluation. As a disadvantage of this case, it is thought that asymptomatic cerebral infarction was not confirmed through brain imaging after surgery.

Change in the text:

(see Page 3, line 43~45)

“There were no preoperative neurological deficits observed, and no abnormalities were observed on brain magnetic resonance imaging.”

(see Page 3~4, line 63~64)

“Bilateral regional cerebral oxygen saturation values did not drop below 55% during the operation.”

(see Page 5, line 87~89)

“There are several points for discussion including limitations of this study. One of the potential drawbacks of this case is the possibility that asymptomatic cerebral infarction was not detected through postoperative brain imaging.”

Comment 2: Was the implant as destination therapy (in view of the age) or bridge to transplant? Some comments on the limitations of this approach for bridge to transplant LVAD is warranted, even if this was a DT case.

Reply: I agree with your opinion. In this particular case, we took into account the patient's age of over 70 and, after consulting with them, we decided to insert an LVAD for the purpose of destination therapy. However, for LVADs intended as a bridge to transplantation, we will include a further discussion of potential drawbacks that may arise during subsequent heart transplantation in the discussion section. Thank you for helping to improve the completeness of the paper.

Change in the text:

(see Page 3, line 46~47)

“for the purpose of destination therapy”

(see Page 5, line 89~96)

“We opted for LVAD implantation for destination therapy in this patient. However, had we performed it as a bridge to transplant, we anticipate there could be some potential drawbacks to consider. Specifically, significant adhesions around the replaced ascending aortic graft may need to be removed during subsequent heart transplantation, and there could also be difficulties during not only the arterial cannulation for CPB, but also the aortic anastomosis with or without removal of the artificial graft that was replaced. Therefore, it is important to take these limitations into account when planning for LVAD implantation combined with hemiarach replacement as a bridge to transplant.”

Reviewer C

The theme of this paper is a very important issue and I read it with great interest. The authors have reported that LVAD outflow graft was anastomosed to the ascending aortic graft for avoiding perioperative stroke from aortic atherosclerosis. I have the following questions and some comments for authors.

Comment 1: Please include the author's comments following paragraphs line number 70-73. What should be done because of the increase in medial degeneration and atherosclerotic change after LVAD implantation? The authors should clearly indicate logical thought development.

Reply: We chose to replace the diseased ascending aorta in this case of severe atherosclerosis in the patient receiving LVAD implantation, taking into account the paragraphs you pointed out. Through this, we aimed to not only achieve short-term success but also prevent stroke in this patient from a long-term perspective. Of course, more research will be necessary in this regard in the future.

Change in the text:

(see Page 4, line 77~79)

“Therefore, we determined that replacing the entire diseased ascending aorta would be beneficial not only in terms of short-term results but also in preventing stroke in this patient from a long-term perspective.”

Comment 2: What is status of cases with perioperative stroke after LVAD implantation at the author's institution? Also, what are the strategies and historical evolution of avoiding stroke at the author's institution?

Reply: Thank you for the excellent question. However, since our institution has not performed a large number of LVAD procedures and this paper focuses on surgical technique rather than being a research paper, it will be necessary to investigate the results of our institution regarding perioperative stroke rates in future research. Therefore, as you advised, we will conduct further research on LVAD-related stroke in the future. When using the side-biting clamp on the aorta, we aim to locate the healthiest section of the aortic wall to attach the outflow graft with sutures. And we are working to develop additional strategies as we gain more experience.

Reviewer D

The authors present a case report of a patient who underwent Heartmate 3 LVAD implantation with concomitant ascending aorta and hemiarch replacement due to calcified aorta without aneurysm. They achieved a good outcome with the procedure. The manuscript is written well. More detail is needed on why such an extensive procedure is needed on these high risk patients with very bad LV function.

Comment 1: I question the need for a hemiarch and ascending replacement. In the provided figure 1, there is some calcium plaque in the arch near the arch vessels but the ascending aorta does not seem to be calcified.

Reply: Your perspective is valid. Depending on the circumstances, there may be situations where the surgical extent is modified based on the supervising physician's discretion, taking into account the surgical hazards. We have determined that in addition to calcium, irregular appearance of the aortic wall can also be a cause of cerebral infarction, known as atheromatous embolism. If you look closely at Figure 1, you can see that the contrast agent in the ascending aorta is irregularly shaped, indicating severe atherosclerosis in the ascending aorta. Furthermore, epiaortic ultrasonography revealed the absence of a normal segment in the ascending aorta. And severe atherosclerosis was actually found when the ascending aorta was resected.

Assuming we had to replace the distal ascending aorta near the aortic arch, we believed that removing the diseased aorta by replacing the entire ascending aorta, even if there was minor pathology, would provide long-term benefits, not just short-term results. Considering the risk-to-benefit ratio according to the surgical extent and the surgeon's proficiency in aortic surgery, we determined that our decision was not hazardous. Thank you for the great question.

Comment 2: Why was such an extensive aortic replacement necessary? First, why does the aorta need to be replaced? Even if you don't want to clamp the aorta, in the extreme you can use circulatory arrest and perform the outflow anastomosis on any normal patch of ascending aorta. Second, even if you had a porcelain aorta and couldn't put the outflow graft on it, you don't need to do a whole hemiarch. We often perform an "open distal" ascending replacement for porcelain aorta without replacing arch because it's simply unnecessary.

Reply: Your opinion is valid as well, and it is a good suggestion. However, similar to your initial question, we could not guarantee that we would avoid touching the atheromatous plaque while needling the aortic wall around the aortotomy site, even if we selected a healthy-looking segment of the aorta during outflow graft anastomosis without clamping the aorta and inducing circulatory arrest. We have determined that, in addition to calcium, atheromatous plaque that has not yet calcified is also a short and long-term risk factor for stroke after LVAD implantation. Our intention is not to emphasize that the surgical approach we utilized in this case is the sole correct one, but rather to communicate that this approach is also a viable option. Our aim is to share our experience because we were able to complete the surgery without any major complications. We believe that this case could potentially assist someone in making a decision. Furthermore, we will include your exceptional alternative surgical options in the discussion section. Thank you.

Change in the text:

(see Page 5, line 97~102)

"We chose for hemiarch replacement to avoid applying an aortic clamp and replace the entire diseased ascending aorta. Depending on the degree of aortic disease, an alternative approach could be to connect the outflow graft selectively to the healthy aortic wall following circulatory arrest after aortotomy without clamping the aorta. Alternatively, depending on the circumstances, it may be feasible to replace just the severely affected part of the aorta, rather than the entire aorta."

Comment 3: Placing the LVAD is fairly routine but the tough part is often the bleeding from the needle holes of the outflow graft anastomosis. How you have multiple aortic graft suture lines combined with the added coagulopathy of moderate hypothermia and circulatory arrest. How was the bleeding at the end?

Reply: As you pointed out, the needle hole can be a source of bleeding. In this case, there were no difficulties in controlling bleeding after weaning from CPB. In our experience, bleeding from a needle hole at the anastomosis site between artificial grafts is generally well controlled with various topical hemostatic agents.

When connecting the LVAD outflow graft to the native aorta, as in a typical aortic replacement surgery, we have found that it is important to avoid size mismatch, and that additional reinforcement sutures may be necessary to achieve adequate hemostasis, based on our experience. Additionally, while maintaining even spacing during suturing, efforts should be made to reduce surgical time.