

The better can be the enemy of the good. The timing of LV venting during complex open-heart surgery revisited.

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Abstract

We report a young female patient with a complex cardiac surgical history that underwent a redo complex aortic valve replacement. In the context of severe AR and dilated LV, we experienced that it is safer to start the LV venting after aortic cross clamping. In this setting NIRS can be, in this particular context, a useful monitoring tool to prevent potential severe neurological damage.

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ABSTRACT: We report a young female patient with a complex cardiac surgical history that underwent a redo complex aortic valve replacement. In the context of severe AR and dilated LV, we experienced that it is safer to start the LV venting after aortic cross clamping. In this setting NIRS can be, in this particular context, a useful monitoring tool to prevent potential severe neurological damage.

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CASE REPORT

A 66 years old female admitted to our department for a redo aortic valve replacement. A year before, she underwent successful emergency surgery for an acute type A aortic dissection with reconstruction of the aortic root, resuspension of the aortic valve commissures, replacement of the ascending aorta and proximal hemi-arch. One month later, she underwent a percutaneous endovascular insertion of a stented graft in the thoracic descending aorta, which was critically compressed by the increasing diameter of the false lumen at the residual Type B dissection. She developed progressively severe AR with LV dilatation and therefore she underwent aortic valve replacement with a Trifecta² 23 mm bioprosthesis 9 months after the initial procedure. For cerebral perfusion monitoring a NIRS device was placed on the patient before surgery.

After initiating extracorporeal perfusion and to avoid distension of the dilated LV a venting cannula was inserted into the LV through the RSPV. LV venting was initiated with a flow rate of 400 ml/min. The anesthesiologists immediately reported a bilateral significant drop of the brain saturation as evidenced by NIRS device (Fig. 1). After exclusion of the usual causes of cerebral saturation drop, we interrupted the LV venting, as it was the last surgical step done. The values of the cerebral O₂ saturations immediately started improving, returning at the baseline level (Fig. 2). The hemodynamic situation of the patient was stable during all this time period (blood pressure, heart rate, ECC-flow and venous return).

To perform the operation safely, LV venting was then reduced to a minimum until aortic cross-clamping. Thereafter it was increased again. The operation could be completed without further NIRS saturation drop incidents. During the first post-operative sedation break, the patient was neurologically intact. The post-operative evolution was without complications.

DISCUSSION

In complex aortic surgery especially in repairing of dissected aortas or in complex situations where cerebral circulation could be compromised, for example in redo aortic arch surgery, monitoring of the brain perfusion/oxygenation is of paramount importance. New modalities like NIRS that monitor oxygen saturation of the brain (rSO₂) as a surrogate, can give an optimal peri-operative assessment. The NIRS device monitors in real time the cortical regional cerebral oxygenation and gives us an instant information about cerebral perfusion/oxygenation adequacy as well as the incidence and time course of cerebral hypoxia. At the same time, it may help to identify the causes and find methods of preventing and managing cerebral hypoperfusion and hypoxia during cardiac surgery [1].

In our case, the observed NIRS dropped dramatically after the LV venting started. That was probably due to the stealing of a significant amount of anterograde cardiac flow by the LV venting suction in the context of a severe AR. As a result, the brain perfusion was compromised and the brain rSO₂ dropped. By reducing the LV vent drainage (until aortic cross-clamping), we managed to perform the rest of the operation without difficulty.

The use of a LV venting prevents distension of the left ventricle in so avoiding sub-endocardial ischemia to the muscle from excessive stretching. Vents can be placed in the aortic root, left atrium or left ventricle via the left superior pulmonary vein, left ventricular apex, or pulmonary artery. It was originally recommended to insert the LV venting cannula just after applying the cross clamp in the aorta to minimise introduction of air into the left heart and subsequent systemic air embolism [2]. Alternatively, nowadays we are using the RSPV cannulation as a LV venting. To minimize risk of air insertion during cannulation the heart is usually allowed to fill before vent insertion and clamped immediately after connection to the venting cannula of the CPB. This technique, however, can bear complications [3]. This is most likely to occur at the time of insertion or removal of the venting catheter from the RSVP. Finally, errors in function of the suction (positive

pressure in reservoir, misdirection of tubing into roller pump head, reversal of roller pump) may cause air to be pumped into the ventricle. A number of cardiac surgeons to avoid these potential complications refrain from the use of an LV venting and use only a small transvalvular cardiectomy suction while performing valve replacements [4].

We suggest keeping this rare complication of LV venting via the RSVP in mind, in the context of severe AR and dilated LV. In doubt, it is safer to start it after aortic cross clamping. NIRS can be, in this particular context, a useful monitoring tool to prevent potential severe neurological damage.

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Concept/design: SD, TT

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Critical revision of article: TT, SD

Approval of article: SD, TT

Data collection: FF

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FIGURE LEGENDS

Fig 1. NIRS registration of brain saturation during the operation. Noticed that after the venting started to aspirate (first arrow on the left) the flow to the brain suddenly reduced to levels below 40% and when stopped return to its baseline of 70-80%. After stopping the vent and try again later on when the vent has been restarted, the same effect happened again (see the second arrow on the right).

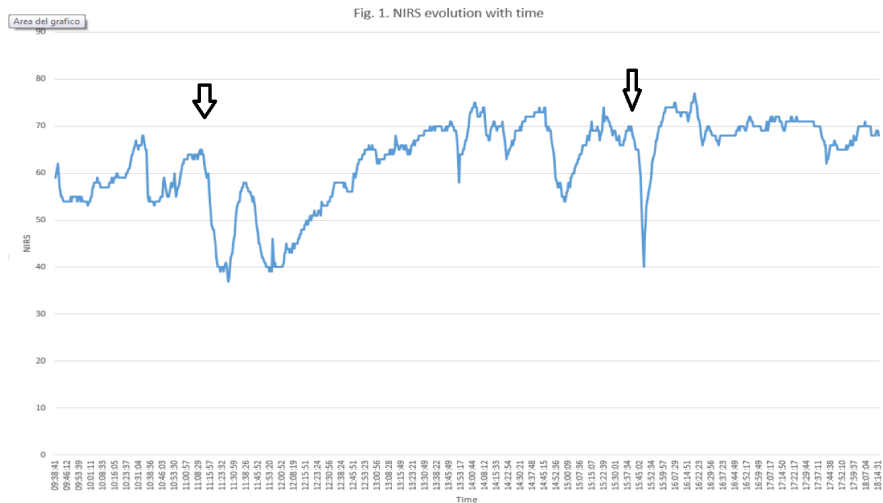


Fig 2. Monitor of the NIRS registration of brain saturation during the operation. Noticed the sudden drop from 70% to below 40% during the institution of the LV venting, and after stopping the venting the return to the baseline of the brain saturations.

