Nonin EQUANOX™ Regional Oximetry (rSO_2) Helps to Manage Distal Limb Perfusion On Extra-Corporeal Membrane Oxygenation (ECMO) with Intra-Aortic Balloon Pump (IABP)

NONIN
rSO_2 CASE STUDY

Case Overview

The patient is a 47-year-old male presenting with cardiogenic shock and cardiac arrest after cardiac catheterization and intra-aortic balloon pump (IABP) insertion. The patient was placed on venoarterial extra-corporeal membrane oxygenation (VA ECMO), with cannulation in the left femoral artery and right femoral vein, and an IABP inserted through the right groin. ECMO cannulation was completed without issue, and four near-infrared spectroscopy (NIRS) sensors (8004CA) were used as an adjunct measure of systemic perfusion. There were significant disparities between the left- and right-calf regional oximetry values, which supported clinical decisions relative to the management of the IABP.

Background:

- 47-year-old male with myocarditis and left-ventricular dysfunction, which decompensated upon catheterization, resulting in cardiogenic shock
- Condition successfully treated with VA ECMO and IABP, and patient discharged to rehabilitation

This case is an excellent example of the value of EQUANOX to monitor both cerebral and distal limb perfusion, and the value of the real-time data to allow intervention before serious tissue damage occurs.

Intensive Care Monitoring

Bilateral cerebral and calf near-infrared spectroscopy (NIRS; Nonin EQUANOX™ 7600 Regional Oximetry System and 8004CA sensors) and a standard suite of intensive care monitoring parameters were used in this case, which included hemodynamic factors of mean arterial pressure, pulmonary artery pressure and central venous pressure. Other key parameters were electrocardiogram, temperature (nasal and arterial), arterial saturation (SaO_2), mixed venous saturation (SvO_2), hemoglobin and hematocrit.

What the Nonin EQUANOX System Showed

Regional oximetry monitoring for this patient was initiated on ECMO. Four NIRS sensors (8004CA) were placed: left- and right-cerebral and left- and right-calf. The decision to place EQUANOX sensors on the posterior portion of each calf on cannulation for ECMO was to monitor saturation and to prevent North-South Syndrome.[1] On initiation of regional oximetry (rSO_2) monitoring, the patient had acceptable cerebral rSO_2 values (average between both hemispheres, 81%), but the right-calf sensor values were unacceptably low, especially when compared to those of the left-calf (19% compared with 49%), suggesting that the IABP catheter, which was positioned in the right groin, was occluding blood flow to right leg. This decrease may have been present since IABP insertion, however, as NIRS monitoring was not initiated until ECMO, it went undetected. Given the observation that the right leg was not being perfused adequately upon arrival in the ICU, discussions with the surgical team led to adjusting the position of the IABP catheter, which satisfactorily increased rSO_2 values in the right calf. Regional oximetry desaturation later in the monitoring period suggested subsequent distal limb desaturation. In both cases, EQUANOX displayed what appeared to be decreased oxygen delivery to the lower right leg and calf. *(See Figure 1 on back page)*

Discussion

This patient had two factors that could potentially jeopardize distal limb perfusion: ECMO cannulation and IABP insertion. Common practice in ECMO is to monitor with regional oximetry, at least in the cerebral position, but often in the calf position as well. So-called "North-South" syndrome can occur when upper and lower body perfusion is not adequate. Also, because these patients are often cannulated for extended periods, there is a danger of distal limb ischemia. Evidence is growing to support NIRS' value to monitor the adequacy of systemic perfusion in ECMO, including both to the brain and to the distal limb.[2] Although there is no evidence to support NIRS in the calf on IABP insertion, it is clinically intuitive to do so, because the presence of a large catheter in the femoral artery can occlude flow to the distal limb. Regional oximetry monitoring on the calf should help insure adequate perfusion to that tissue bed for both ECMO cannulation and IABP insertion.

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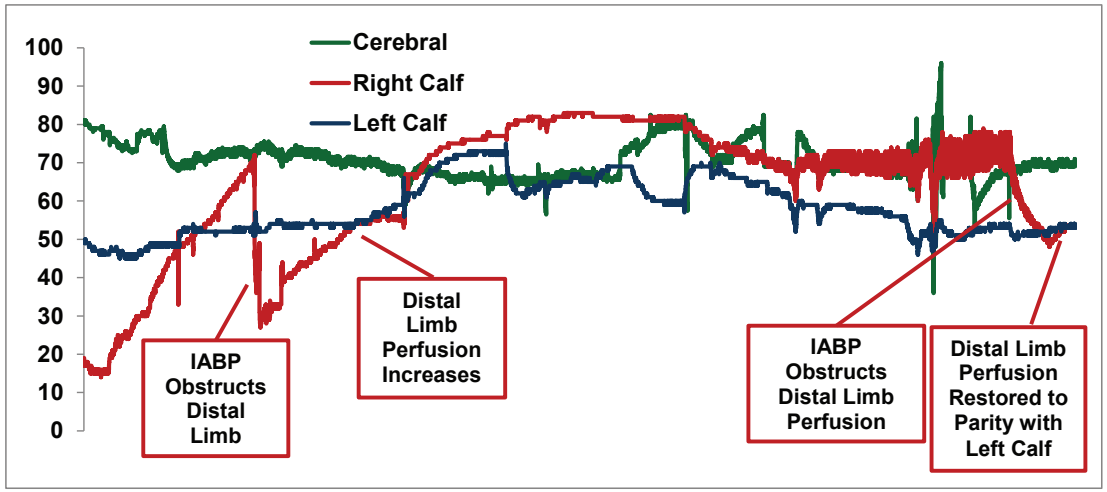

Figure 1: Note in this trend graph that the right leg (red line) shows decreased oxygen saturation upon initiation of ECMO. The sensor and the IABP were adjusted and rSO_2 responded satisfactorily. The next morning a decrease in saturation was again observed, at which point the IABP was pulled from the patient's leg and normal oxygen delivery returned to the right calf.

Nonin rSO_2 proved particularly valuable in this case. It suggested that perfusion to the right calf was markedly decreased from that of the left and potentially at unacceptably low levels. It was a real-time indicator that the IABP catheter in the patient's right leg obstructed blood flow to the distal limb, causing limb ischemia. This case is an excellent example of the value of EQUANOX in monitoring both cerebral and distal limb perfusion, and the value of the real-time data to allow intervention before serious tissue damage occurs.

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[1]Chung M et al; *Scientif World J* 2014; Article ID 393258.
[2]Wong et al; *Artif Organs* 2012; 36:659.

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