

Letters to the editor

Adequate shunt occlusion confirmed by near-infrared spectroscopy in a patient with arteriovenous malformation in the leg

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To the editor: We experienced a case of an adequate increase in lower leg oxygenation resulting from coil embolization of arteriovenous malformation (AVM), which was well confirmed by near-infrared spectroscopy (NIRS).

The patient (23-year-old woman, weight 58 kg, and ASA physical status 1) had been diagnosed as having leg arteriovenous malformation (AVM). The malformation extended largely from her left inguinal ligament to her knee, and she complained of severe pain and was medicated with buprenorphine 0.6–1.2 mg every day after admission to our hospital. A chest X-ray showed a large cardiothoracic ratio (62%) resulting from the large shunts through the AVM. Interventional therapy with a gelatin sponge was then performed twice, but the procedure resulted in focal ischemia and bleeding. Her thigh was almost entirely covered with ulcers, and skin hyperemia was present thereafter. Shunt occlusion with a coil graft via the aorta was scheduled under general anesthesia with epidural anesthesia.

In the operating room, NIRS probes (INVOS 4100; Somanetics, Troy, MI, USA) were placed over both calf muscles in addition to standard monitoring, and the oxygen saturation of tissue (St_{O_2}) was 89% in the right leg and 63% in the left leg, respectively. After the procedure of thoracic epidural block, general anesthesia was induced with 2 mg kg⁻¹ propofol with 0.12 mg kg⁻¹ vecuronium and maintained with 1.5%–2% sevoflurane in oxygen. After the aorta was partially clamped, St_{O_2} in both legs rapidly decreased (Fig. 1A). An artificial vascular graft was sutured to the aorta, and the aorta was then declamped (Fig. 1B). St_{O_2} became close to the values before the partial occlusion. An interventional coil graft was inserted via the graft into the largest shunt (Fig. 1C). With an assistance of endovascular color doppler echography, the coil graft was expanded to close the shunt. St_{O_2} decreased gradu-

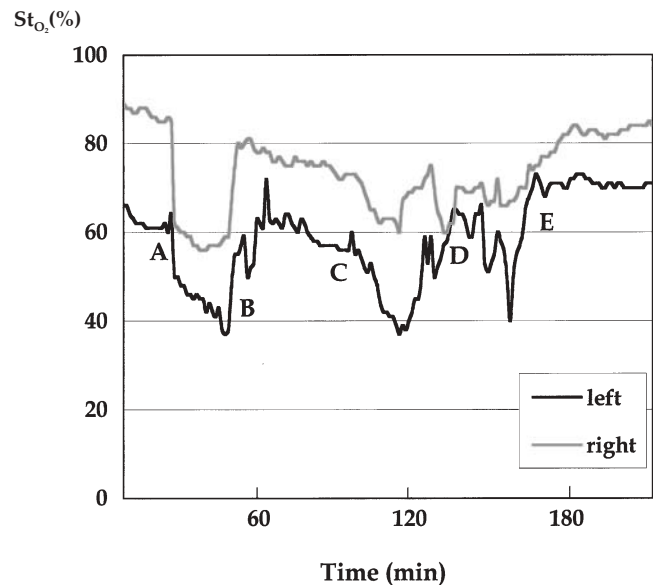


Fig. 1. Changes in oxygen saturation of tissues (St_{O_2}) at right and left calf muscles as measured by near-infrared spectroscopy during surgery. *A* The aorta was partially clamped, and the St_{O_2} in both legs rapidly decreased. *B* An artificial vascular graft was sutured to the aorta, and the aorta was then declamped. *C* An interventional coil graft was inserted via the graft into the largest shunt. *D* Balloon dilation of the coil graft was performed twice. *E* After balloon dilation, St_{O_2} increased, suggesting that shunt occlusion was successful

ally during the endovascular procedure and increased after the expansion of the coil graft (Fig. 1D). The left St_{O_2} increased to the preoperative value but did not exceed it. Angiography showed an AV end leak caused by a poor fit of the coil graft to the vascular wall. Balloon dilation of the coil graft was then performed twice, and the left St_{O_2} exceeded the value before the operation (Fig. 1E). The shunt occlusion was thought to be successful due to the increased St_{O_2} , and the operation was finished. After the operation, the patient complained of little pain on the leg, and some of the ulcers disappeared thereafter.

NIRS is a noninvasive, inexpensive, and reproducible technique [1] that is used in a range of clinical conditions [2,3] and

has been shown to be useful for monitoring tissue oxygenation [4]. Nakayama et al. [5] reported that in aortoocclusive disease the success of revascularization was associated with an immediate postoperative increase in St_{O_2} above the preoperative value. In this case, we were able to detect an increase in lower extremity oxygenation and adequate shunt occlusion confirmed by NIRS intraoperatively. The results indicate that NIRS monitoring of skeletal muscle can be applied to assess the efficacy of sufficient blood flow.

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