

# Sublingual microcirculation reveals fluid overload and leukocytosis in a post-cardiac surgery patient

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## DESCRIPTION

Positive cumulative fluid balance caused by excessive fluid administration during the perioperative phase is known as one of the most common clinical complications in post-intensive care unit cardiac surgery patients.<sup>1</sup> Mostly, administration of diuretics is initiated to correct the fluid overload. However, there is no clinical parameter showing the changes in the fluid balance, while daily measurements of weight and fluid balance are initiated to help to manage diuretic therapy. Herein, we present a case report, in which we show that sublingual microcirculation monitoring (SMiMo) may provide an additional check on optimal filling status in these patients apart from recording fluid balance and weight control.

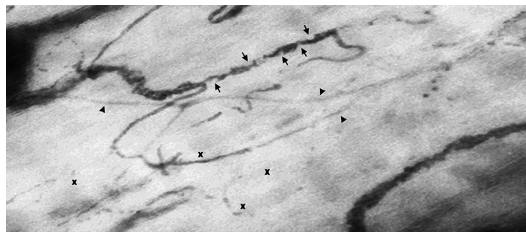
A 75-year-old woman with a history of B cell chronic lymphocytic leukaemia diagnosed with aortic valve stenosis was admitted for transcatheter aortic valve replacement (TAVR). Patient was discharged from the intensive care unit with a cumulative positive fluid balance of 1800 cm<sup>3</sup> and transferred to the cardiac ward. The patient's body weight increased after surgery and was followed by a gradual decrease in the subsequent days (preoperative weight: 64.5 kg, 2 days after surgery: 66.7 kg, 3 and 4 days after surgery: 65.2 and 64.7 kg, respectively). Patients with a severe aortic stenosis suffer from left ventricular hypertrophy requiring careful fluid management.

Therefore, the patient received oral administration of 40 mg furosemide and 25 mg spironolactone per day for the following 3 days to correct fluid overload.

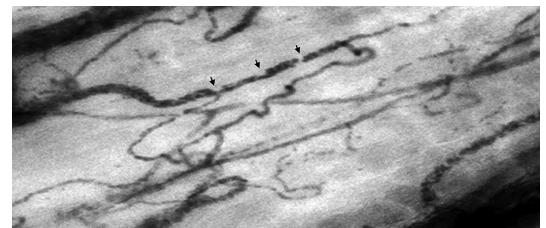
Fluid overload and its microcirculatory impact secondary to cardiac surgery was assessed by SMiMo, using incident dark-field imaging (CytoCam-IDF, Braedius, Huizen, The Netherlands). The CytoCam is a handheld microscope emitting green light with a 548 nm wavelength. The green light ensures optimal absorption by oxyhaemoglobin and deoxyhaemoglobin, through which the red blood cells become visible.<sup>2</sup>

Images were recorded on day 1 (T0) (figure 1) and day 3 (T1) (figure 2) after TAVR, respectively, showing a substantial increase in vessel density. This significant change can be assessed visually at the same anatomical sublingual site. This is the first report showing a visual effect of diuretic therapy on peripheral microcirculation in a fluid overloaded patient. SMiMo allows comparison of both images without offline analysis, which is usually required. In addition, leukocytosis was also observed at both time points. Subsequent decrease in leucocyte count detected in blood samples ( $16.3 \times 10^9/L$  at T0 decreased to  $14.5 \times 10^9/L$  at T1) could also be observed on CytoCam images at the same microvascular site.

Offline analysis using dedicated software (Automated Vascular Analysis, AVA, Microvision Medical, Amsterdam, The Netherlands)<sup>3</sup> showed an increase in microcirculatory density parameters (total vessel density and perfused vessel density). Microcirculatory flow parameters (proportion of perfused vessels and microvascular mean flow index) showed a minor change indicating a stable flow (see legends of figures 1 and 2).



**Figure 1** Sublingual microcirculation 1 day after surgery. Screenshot of video recorded on day 1 (T0) after TAVR. Arrowheads show decreased diameter of vessels shown in figure 2. Crosses indicate disappeared vessels which can be seen in figure 2. Black arrows indicate leukocytes sticking and rolling in a postcapillary venule. Microcirculatory parameters: total vessel density 22.6 mm/mm<sup>2</sup>, perfused vessel density 21.6 mm/mm<sup>2</sup>, proportion of perfused vessels 96.0% and microvascular mean flow index 3.0.



**Figure 2** Sublingual microcirculation 3 days after surgery. Screenshot of video recorded 3 days (T1) after TAVR. This is the first time that a patient follow-up of the sublingual microcirculation is obtained at one and the same microvascular bed. Compared with figure 1, the vessel density has increased, and black arrows indicate leukocytes that are sticking and rolling in a postcapillary venule. Microcirculatory parameters: total vessel density 32.2 mm/mm<sup>2</sup>, perfused vessel density 31.36 mm/mm<sup>2</sup>, proportion of perfused vessels 97.3% and microvascular mean flow index 2.9.



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## Learning points

- ▶ Fluid overload is a common complication after cardiac surgery caused by haemodynamic resuscitation performed during the surgical procedure.
- ▶ Patients with a severe aortic stenosis suffer from left ventricular hypertrophy requiring careful fluid management.
- ▶ Sublingual microcirculation monitoring may provide an additional check on optimal filling status in critically ill patients apart from recording fluid balance and weight control.

The patient was discharged from the cardiac surgery ward on postoperative day 5 once a normal weight and fluid balance were obtained.

**Contributors** ZU participated in the design of the case report, data collection (sublingual microcirculation measurements), the Automated Vascular Analysis of the sublingual microcirculation measurements, interpreted, drafted and revised the

manuscript. CI and TvG helped to draft and revise the manuscript. BAdM participated in the design of the case report, contributed by providing the facilities and drafted and revised the manuscript.

**Competing interests** None declared.

**Patient consent** Obtained.

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