Detection of the effects of the end-expiratory occlusion test with the plethysmography perfusion index to detect preload responsiveness

A Beurton 1; F Gavelli 2; JL Teboul 2; N De Vita 2; X Monnet 2

1Hôpital de Bicêtre, Service de réanimation médicale, Inserm UMR S_999, Université Paris-Sud, Assistance Publique Hôpitaux de Paris, Service de réanimation médicale, Inserm UMR S_999, Université Paris-Sud, , Le Kremlin Bicêtre, France, 2Hôpital de Bicêtre, Service de réanimation médicale, Inserm UMR S_999, Université Paris-Sud, Assistance Publique Hôpitaux de Paris, Le Kremlin bicêtre, France

Introduction:
The end-expiratory occlusion (EEXPO) and end-inspiratory occlusion (EIXPO) tests consist in interrupting mechanical ventilation for 15-sec and observing its effects on cardiac output with direct measurements of CI. The perfusion index (PI) is the ratio between the pulsatile and the non-pulsatile portions of the plethysmography signal. It is in part determined by stroke volume and can detect a positive passive leg raising (PLR) test. We hypothesised that the changes in PI could detect a positive EEXPO test and thus preload responsiveness in a totally non-invasive way.

Methods:
In critically ill patients, we measured PI (Radical 7, Masimo) and CI (PiCCO2, Pulsion Medical Systems) before and during a PLR test, a 15-sec EEXPO and EIXPO tests and, if decided, before and after volume expansion (VE) (500-mL saline).

Results:
We included 31 patients. In 19 patients with a positive PLR test (increase in CI ≥ 10%), CI and PI increased during PLR by 17±7% and 49±23%, respectively, and during EEXPO test by 6±2% and 11±8%, respectively. During EIXPO, CI and PI decreased significantly by 12±4% and 11±9% respectively. In the 12 patients with a negative PLR test, PI did not significantly change during PLR, EEXPO and EIXPO tests. Only four patients received VE, causing an increase of CI and PI by 15±3% and 32±47% respectively. The correlation between the PI and CI PLR-induced changes was significant (r = 0.84, p<0.001). During the EEXPO test, if PI increased by >5%, a positive response of CI (≥5%) to the EEXPO test was diagnosed with a sensitivity of 87 (60-98)% and a specificity of 94 (70-100)% (AUROC curve: 0.92 (0.77-0.99), p<0.0001). During the combination of EEXPO and EIXPO tests, if PI increased by >9%, a positive response of CI to the EEXPO test was diagnosed with the same sensitivity and specificity.

Conclusion:
An increase in PI >5% during an EEXPO test accurately detects a positive response of CI to the EEXPO test.