

Estimation of Cardiac Output by using surface electrodes for measuring the impedance plethysmography.

Eva Gabarrón¹, Erik W Jensen¹, Pedro L Gambus².

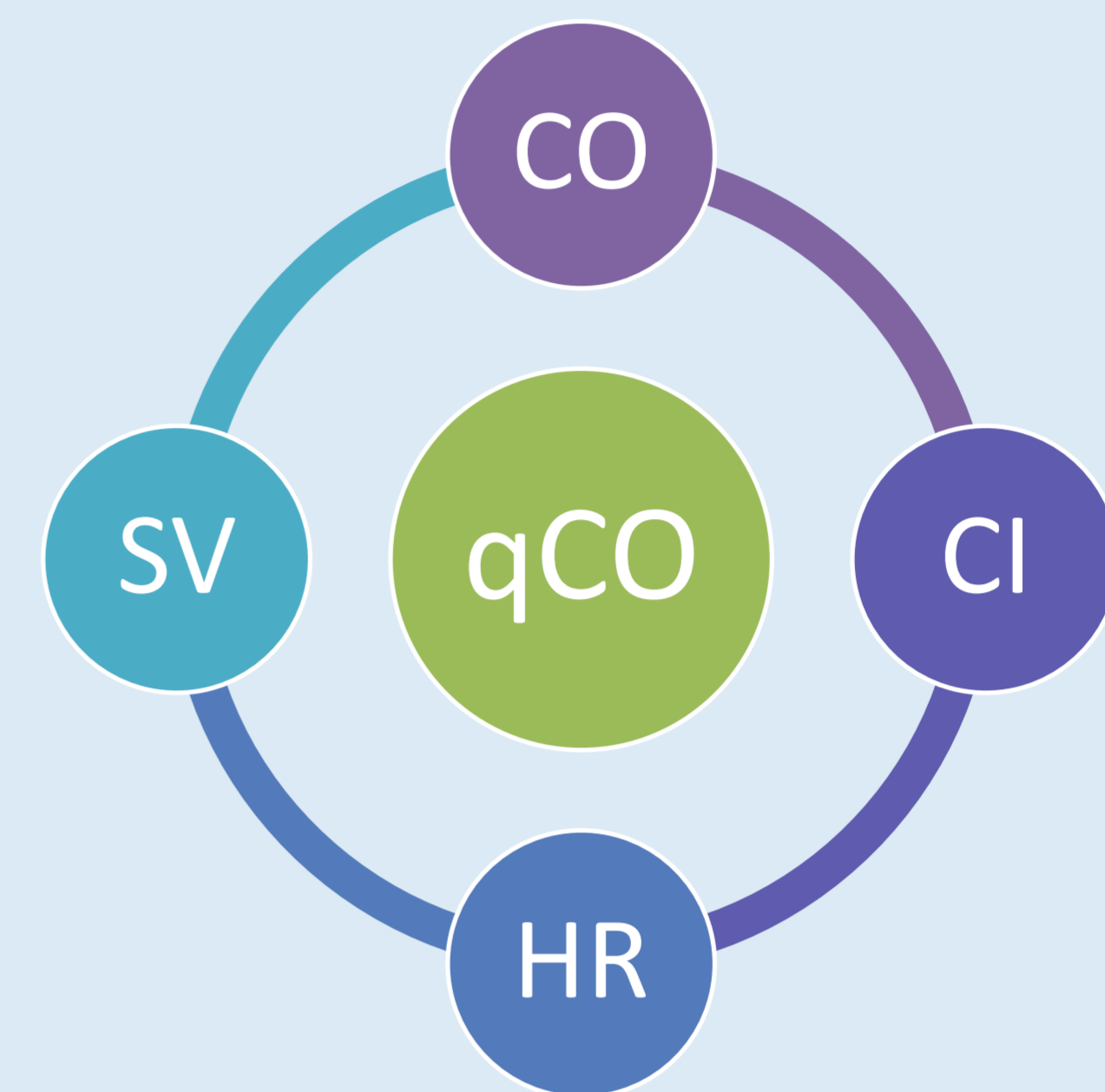
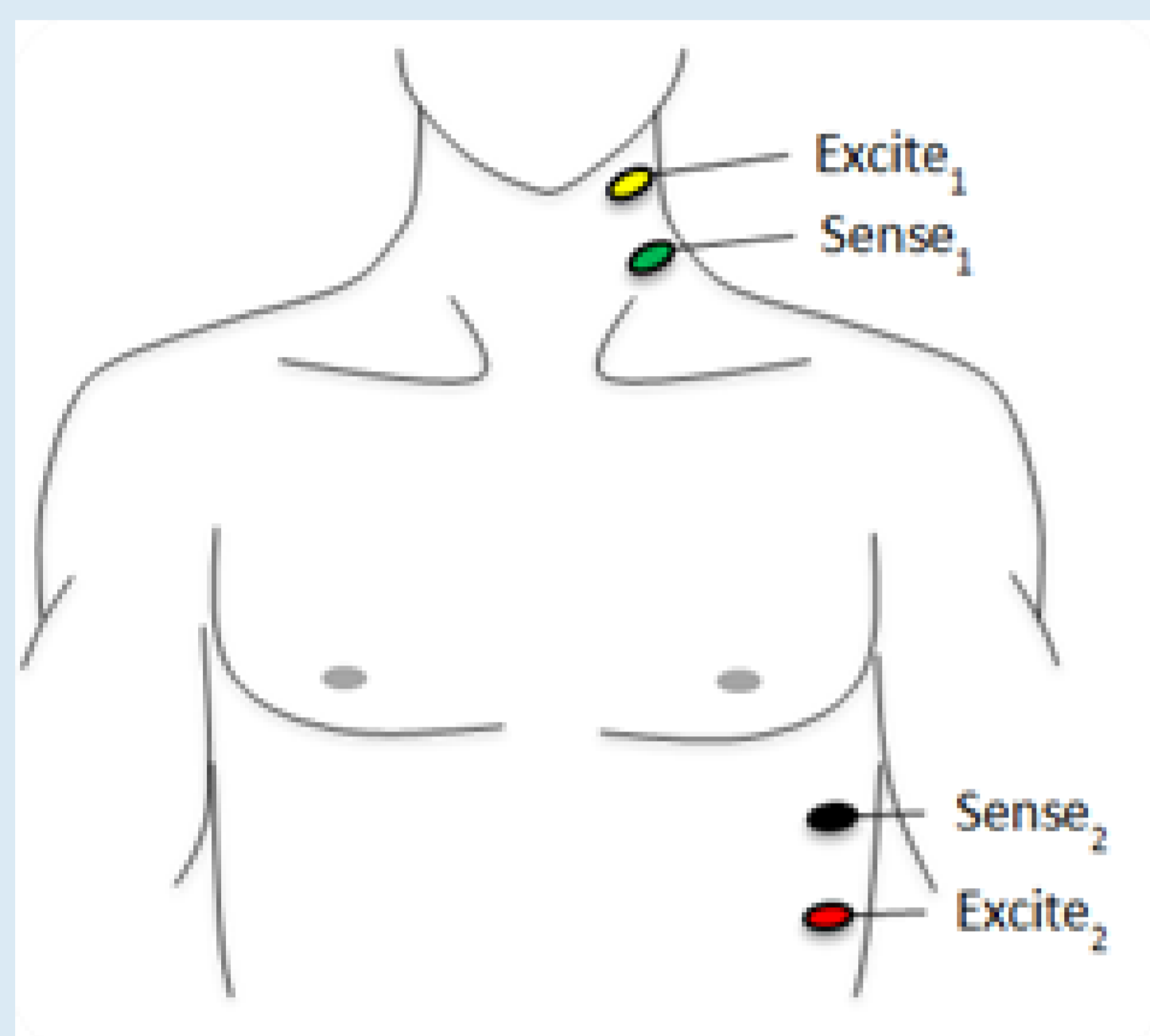


¹Centre for Biomedical Engineering Research, UPC BarcelonaTech, ESAII, Barcelona, Spain.

²Hospital Clinic Barcelona, Anesthesiology Dpt, CMA-Section, Barcelona, Spain.



Introduction. The qCO (Quantum Medical, Spain) is a recently developed monitor to register the CO (Cardiac Output) using impedance cardiography and advanced signal processing.



The electrodes on the extremities apply an electrical current at 50 KHz and low amplitude and so the inner electrodes (called measuring electrodes) can measure variations in the impedance over time. This measure is related to the systolic volume which is converted to CO mathematically with the simple equation $CO = SV * HR$. (SV= Stroke volume; HR= Heart Rate)

Materials and methods. Forty patients scheduled for ambulatory surgery under general anaesthesia were included in this study. The mean age of the patients was 56 years, 36% of them were males and 64% females. Intervals of data were averaged in three different periods of the procedure, before the induction, during surgery and after recovering the consciousness. Test for significant differences among the three groups was carried out with the Student t-test.

Results

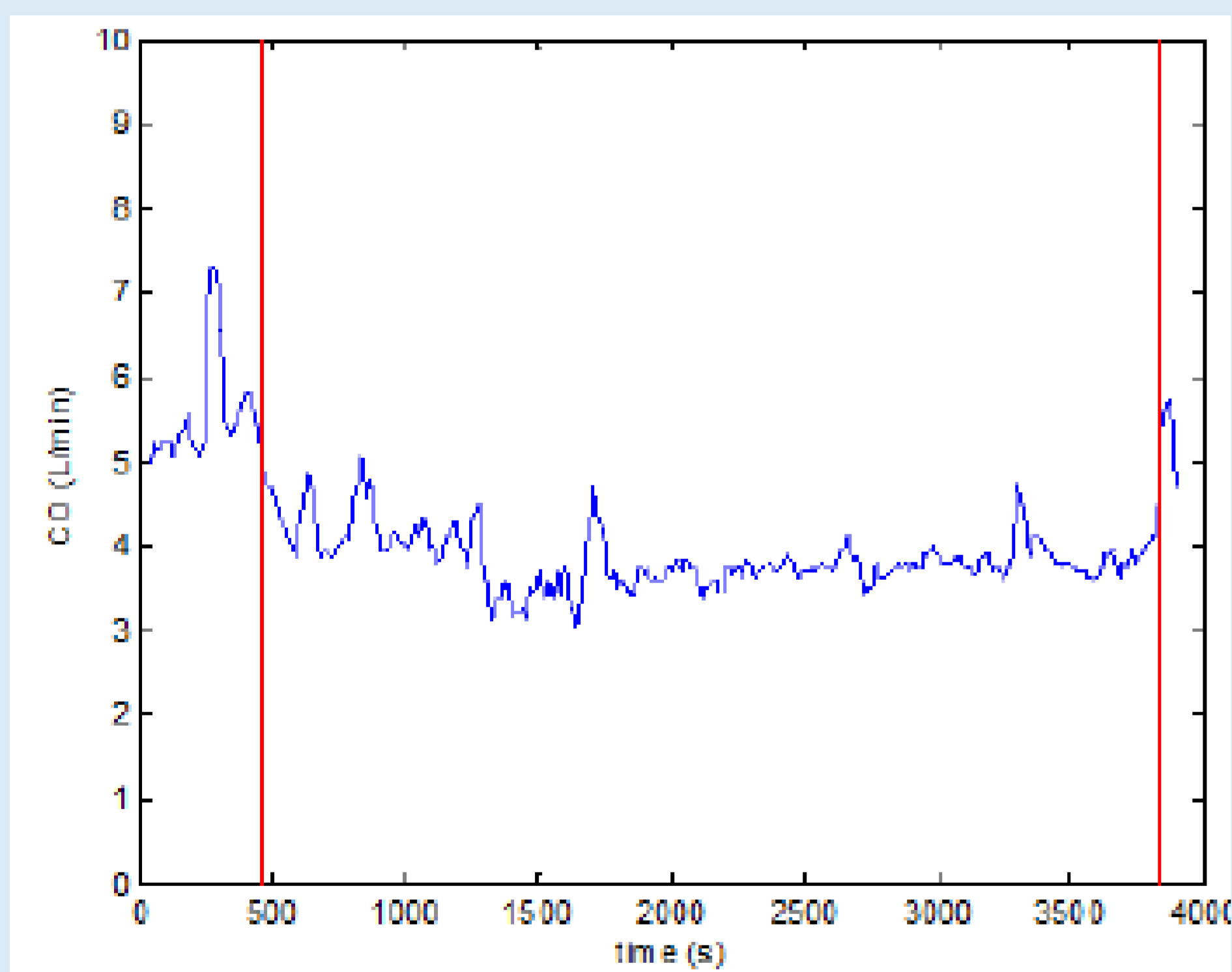


Figure 1. Example of a qCO recording. Eye-lash reflex was lost at 460 s and recovery of consciousness at 3828s.

Table 1 shows the mean values of the CO before induction (pre-anaesthesia), during anaesthesia and after recovery.

	mean CO ± ES	SD
Pre-anaesthesia	4.835 ± 0.397	1.486
Under anaesthesia	3.717 ± 0.225	0.844
Post anaesthesia	5.160 ± 0.535	1.693

Table 2 shows the T student test for independent samples.

Groups	p-value	CI
Pre/ Under	0.0214	(0.1799; 2.0579)
Under/ Post	0.0113	(-2.5277; -0.3602)

The t-test showed significant differences for both Pre-anaesthesia vs anaesthesia and anaesthesia vs post-anaesthesia with a 95% of confidence ($p < 0.05$). The CO decreased 23% during anaesthesia.

Reference. Validation of the qCO cardiac output monitor during Valsalva maneuver. Jospin M, Aguilar JP, Gambus PL, Jensen EW, Vallverdu M, Caminal P. Conf Proc IEEE Eng Med Biol Soc. 2012;2012:240-3

Conclusion: Cardiac Output can be assessed continuously with qCO, using the impedance cardiography.