

Modelling of respiratory mechanics during cardiopulmonary resuscitation

Carlos Babiera Sancho

Automatic Control, Lund University

2019

Popular scientific summary

The blood provides the cells of the human body with the necessary nutrients and gaseous exchange, and it is pumped by the heart through the arteries in order to go across all the body to reach this purpose. Once all the nutrients have been transported and the gases exchanged, the blood returns across the veins to the heart waiting to obtain gases again from the lungs just before it gets pumped again through the arteries.

As every organ, the heart has its own veins and arteries. Cardiac arrest is a common disease that stops heart arteries blood flow, leading the cells to death due to lack of the oxygen provided by respiration and blood circulation. Its medical treatment consists of cardiopulmonary resuscitation, comprising chest compressions and ventilation, to recover the normal functioning of the heart.

A useful way to study new cardiopulmonary resuscitation techniques is by getting a mathematical model of the process to test simulations on it. This thesis has built two suitable models that capture the basic physiological behaviour of the respiratory mechanics during cardiopulmonary resuscitation. The models are based on electric circuits in order to simplify the process in a more intuitive way.

To evaluate the accuracy of the resulting models, their results have been compared to the ones obtained in a previous study, which has compared two cardiopulmonary resuscitation ventilation methods: continuous insufflation of oxygen, CIO, and phase-controlled intermittent intratracheal insufflation of oxygen, PIIO.

Although the models give values that do not match exactly with the results obtained in the study, they capture qualitative differences between the ventilation methods. This means that the models are accurate enough to observe discrepancies and therefore work with them, but they need to be improved in order to have a higher and more precise quantitative differences between different ventilation methods.