THE VIRTUAL CARDIO-RESPIRATORY SYSTEM: A SUB-MODEL OF GAS EXCHANGE AND TRANSFER

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A virtual cardio-respiratory system (CRS) is proposed for testing ventilatory support and scientific hypothesis. It may appear more convenient than experiments on animals or limited investigations on patients. In particular, there are no limitations for manipulation of virtual CRS parameters while such manipulation is difficult or impossible in the case of real CRS. The virtual CRS architecture: The proposed virtual CRS consists of: (a) the sub-model of respiratory system mechanics (RSM) previously used as the stand-alone virtual respiratory system, (b) a sub-model of gas exchange and transfer in the respiratory and circulatory systems (GET), which is constituted with three modules: gas transfer in respiratory system, gas exchange in lungs, and gas transfer in circulation. The GET utilizes airflows and pressures supplied by the RSM whereas the RSM utilizes volumes of gases supplied by the GET. Results: the CRS gave proper results for both respiration and respiratory arrest In particular, if the CRS 'respired' with pure oxygen then arterial blood saturation with oxygen remained high for tens of minutes after respiratory halt when airways were open; otherwise atelectasis developed during 8-10 minutes. Like for real patients, carbon dioxide tension in blood decreased quickly when ventilation increased and it increased slowly when the ventilation fell.

Keywords: oxygen, carbon dioxide, respiratory arrest, respiratory system, saturation, virtual organs