

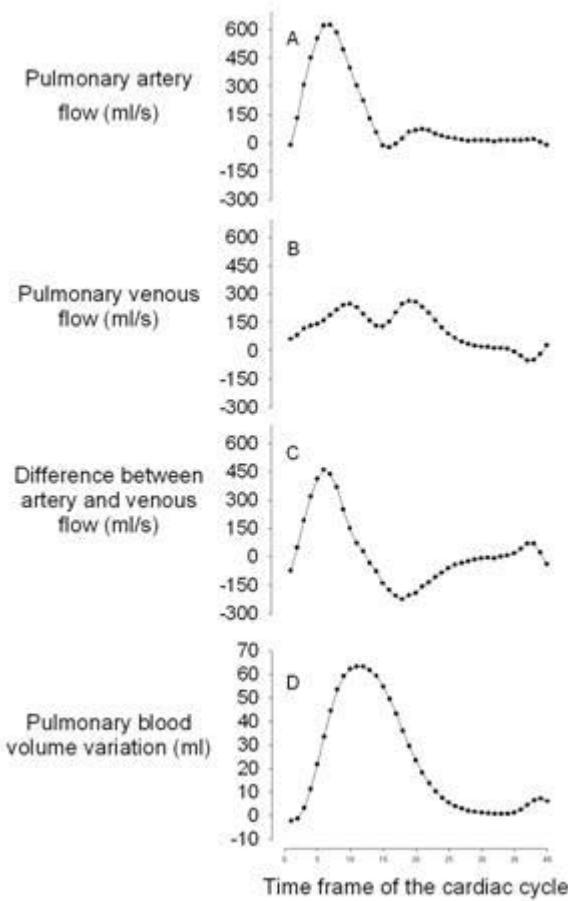
The pulmonary blood volume varies throughout the cardiac cycle in healthy subjects – a novel method for quantification by MRI

M. Ugander¹, E. Jense¹, and H. Arheden¹

¹Clinical Physiology, Lund University Hospital, Lund, Sweden

BACKGROUND: The pulmonary blood volume varies during the cardiac cycle, but measuring this variation has been either cumbersome or of limited accuracy. This study aims to present a novel method for using magnetic resonance imaging (MRI) to quantify the variation in pulmonary blood volume throughout the cardiac cycle in humans.

METHODS: 10 healthy volunteers (7 males, 3 female, age range 21-30 years) were studied. The blood flow in the pulmonary artery and all pulmonary veins was quantified during free breathing using velocity encoded MRI (Philips 1.5T). The difference in flow between the pulmonary artery and the pulmonary veins was integrated to calculate the change in pulmonary blood volume throughout the cardiac cycle. See figure.



RESULTS: The stroke volumes in the pulmonary artery and the sum of the pulmonary veins were (mean \pm SEM) 103 ± 19 ml and 95 ± 19 ml, respectively. During systole, the pulmonary blood volume increased to a maximum of 45 ± 14 ml. This occurred 316 ± 32 ms after the R-wave from the ECG (33 \pm 6 % of the cardiac cycle). The pulmonary blood volume variation expressed as percent of the pulmonary artery stroke volume was 43 ± 10 %.

CONCLUSIONS: It is feasible to quantify the change in pulmonary blood volume during the cardiac cycle using MRI. The pulmonary blood volume in healthy volunteers increases on average just under 50 ml during systole and this was approximately 45% of the stroke volume. Further studies are needed to assess the utility of the pulmonary blood volume variation as a measure for identifying cardiac and/or pulmonary vascular disease.