Help, I gained weight during surgery!

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Help, I gained weight during surgery! 
Perioperative volume status modelling to prevent hypo- and hypervolemia in surgery

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Introduction
During major surgery patients can lose large amounts of blood. To correct for this fluid loss, intravenous fluids are administered. Currently the goal is to restore normal hemodynamic values. A serious side effect of this treatment is fluid overload and edema formation1.

Whereas young patients can easily handle this fluid overload, elderly patients are at risk of developing hypoxia and organ failure4. This is an increasingly important problem, due to increased life expectancy.

Aim
Create a tool to provide more insight in the fluid balance of patients experiencing severe blood loss compensated by fluid administration, eventually to be used in clinical decision making.

Methods
The novelty of this project will be to combine a fluid distribution model with models of the cardiovascular and respiratory system.

A suitable fluid distribution model was found in literature, published by Gyenge et al (1999)5. The proposed model setup is shown in figure 3.

Figure 1: Complications resulting fluid overloading2,3

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Figure 2: Clinical decision support workflow

Figure 3: Schematic overview of the the proposed interaction of fluid distribution-, cardiovascular-, renal and pulmonary modules.

Preliminary results
Preliminary results are comparable to experimental data by Watenpaugh et al.6

With the model we can provide extra information about the other compartments. In the figure below the effect of an infusion of 2.1 L saline in 30 minutes is shown.

Figure 4: Results of the Watenpaugh simulation: fluid input (A), output (B), model and experimental volume changes in the plasma (C) and extra model signals (D-F)

Conclusion
The model by Gyenge et al. is capable of simulating the complex fluid distribution. To investigate the effect of fluid therapies and hemorrhage this model must be extended with cardiovascular and pulmonary compartments, especially considering regulation.

References