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A NUMERICAL METHOD FOR SIMULATING GASTRIC FLOW

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Functions of the stomach are storage, mixing and emptying of gastric contents. Because of the difficulty in the visualization of gastric flow with medical imaging techniques, it remains unclear how these functions are achieved. We developed a numerical model of gastric mixing based on an anatomically realistic geometry and free-surface flow modeling[1], where graphics processing unit (GPU) computing of the moving particle semi-implicit (MPS) method[2] is employed. We revealed that the time averaged recirculating flow generated in the stomach mixes gastric contents. We also revealed that solid particles concentrate in the distal stomach during gastric mixing. A drawback of this model is high computational load. In the MPS method, a linear system must be solved to obtain pressure field, but this process decreases the efficiency of GPU computing. Hence, we reconstruct the numerical model of gastric flow by using a fully explicit particle method, the delta-smoothed particle hydrodynamics (delta-SPH) method[3]. The delta-SPH method has a numerical diffusion term in the discretized equation of the continuity equation. This diffusion term possesses the same effect with upwind schemes, which reduce numerical oscillations caused by advection. The delta-SPH method has been used for flows in simple wall boundaries, and the procedure to give complex moving wall boundary conditions has not been fully established. We apply the ghost fluid method[4] with fixed ghost grid points (particles)[5] to the moving boundary condition.

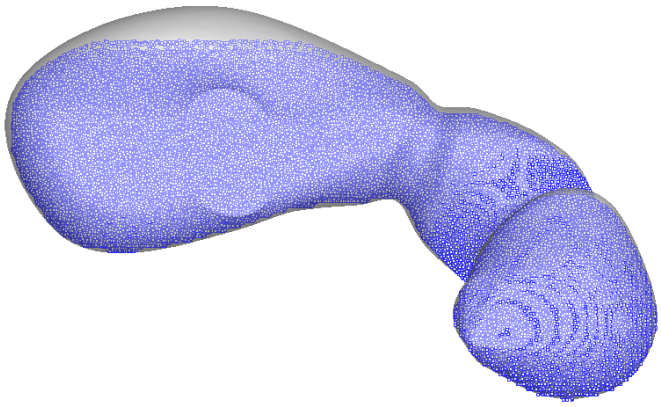

Figure 1. Model of the stomach.

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