This work uses a simplified numerical model to explore the forces on an infant during human birth. Numerical results are compared with the results of a physical model which represents the fetus moving through the birth canal using a rigid cylinder (fetus) that moves at a constant velocity through the center of a passive elastic tube (birth canal). The entire system is immersed in a highly viscous fluid; low Reynolds number allows the Stokes equations to approximate fluid behavior. The pulling force necessary to move the rigid inner cylinder at a constant velocity through the tube is measured, and considered along with the time-evolving behavior of the elastic tube. The discrete tube through which the rigid cylinder passes has macroscopic elasticity matched to the tube used in the physical experiment. The buckling behavior of the elastic tube is explored by varying velocity, length, and diameter of the rigid cylinder, and length of the elastic tube. More complex geometries as well as peristaltic activation of the elastic tube can be added to the model to provide more insight into the relationship between force and velocity during human birth.