The 8th European Congress on Computational Methods in Applied Sciences and Engineering
ECCOMAS Congress 2022
5-9 June 2022, Oslo, Norway

Numerical simulation of the onset of the second stage of labor

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Keywords: *Finite Element Simulation, Labor, Fetal Head Molding, Fetal Brain Loading*

During vaginal labor, the fetal head molds to accommodate the geometric constraints of the birth canal. Molding of the skull causes a change in the shape of the brain and excessive molding can produce birth related brain injuries and long-term sequelae [1]. While previous research focusing on fetal head molding has predicted the loading experienced by the fetal skull during the first stage of labor (before entering the vaginal canal) [2, 3], and the molding during the second stage (descent through the vaginal canal) [4], an in silico model predicting the loading of the fetal brain has still not been proposed. This study proposes a finite element model of the fetal head and maternal canal environment, capable of predicting the stresses experienced by the fetal brain during the onset of the second stage of labor. Both fetal and maternal models were adapted from existing studies to better represent the anatomy of full-term pregnancy. Labor was simulated by imposing a trajectory onto the fetal head. This study provides insight into the level and location of stresses that can occur in the fetal brain during the onset of the second stage of labor and offers a simulation platform for the study of labor complication scenarios and their effect on the fetal brain. Preliminary results of different case scenarios will be presented.

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