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Reflectance spectrometry of placental vessels in cases of twin-twin transfusion syndrome: experiments and modeling COLLIN LINES, OLEG KIM, University of Notre Dame, JOHN MCMURDY, None, FRANCOIS LUKS, Division of Pediatric Surgery and Maternal-Fetal Medicine, Alpert Medical School of Brown University, MARK ALBER, GREG CRAWFORD, University of Notre Dame — A stochastic photon transport model in multilayer skin tissue combined with reflectance spectroscopy measurements is used to study placental vessels in cases of twin-twin transfusion syndrome (TTTS). TTTS occurs in about 12% of monozygotic (identical) twin pregnancies wherein flow within placental vessels linking the twins together becomes unbalanced, leading to dual mortality. Endoscopic laser ablation can halt the syndrome by occluding the anastomoses connecting the two fetuses. The objective of this study is to develop a technique to determine hemoglobin (Hb) content through spectral analysis of diffuse reflectance spectra of placental vessels to aid in identification of the anastomoses. Previous work by researchers at Brown University has shown that the reflectance spectra of the donor twin and recipient twin are considerably different in the wavelengths for Hb absorbance. This presentation will give preliminary results for a Monte Carlo model adapted to fit the physiology of the placenta that can be used to quantitative determine the Hb levels. The reflectance spectra of the vessels are simulated for different values of Hb as well oxygenation and water concentration with the vessel and placental mass. The preliminary results will be shown to be in good approximation with the prior experimental data. The combination of modeling with spectroscopic measurement will provide a new tool for detailed prenatal study.

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