

PREDICTION OF FIRST TRIMESTER PREGNANCY OUTCOMES BY ANALYZING SPENT CULTURE MEDIUM WITH PHOTONIC CRYSTAL WAVEGUIDES SENSORS AND MACHINE LEARNING ALGORITHM.

Gryaznov, Alexey¹; Skibina, Julia²; Yanchuk, Natalia¹; Chainikov, Mikhail²; Silohin, Igor²; Shuvalov, Andrey²; Zanishevskaya, Anastasia²

¹Family planning center of Pushkin district, Russia, ²LLC SPE "NGT" (Nanostructured Glass Technology), Russia

Abstract Body

Now we present a gaining popularity in optics and biophotonics new method for analyzing liquid media based on photonic crystal waveguides, which can significantly increase the sensitivity of the test and reduce the time it takes to conduct it. We collected 285 samples of spent medium from individually cultured blastocysts that were transferred into uterine cavity (only single embryo transfers included) in fresh and frozen cycles. In all cases women had no uterine factor of infertility (endometrium 5-14 mm, no signs of any other intrauterine abnormalities), and no autoimmunity (as a risk factor of early pregnancy loss). The analysis of those samples was done at spectrometer with photonic crystal waveguide. Obtained metabolomic curves were processed with machine learning algorithms in open source R-studio program; all embryo transfer outcomes were divided into two groups: positive (ongoing pregnancy at gestational age of 12-14 weeks with no chromosomal disease markers) and negative (negative HCG test, miscarriage, detected aneuploidy, etc), ectopic pregnancies were excluded. In all cases no technical errors with embryo transfer were recorded. To build a predictive model 70 percent of data (199 cases) was used as a training frame. To test the model performance residual 30 percent of data (86 cases) was used. Key parameters of model evaluation on testing subgroup: true positive rate (TPR) – 0,94; false positive rate (FPR) – 0,02; true negative rate (TNR) – 0,98; false negative rate (FNR) – 0,05; accuracy – 96,5. Misclassification error for entire data set clustering (training and testing) – 0,01 (accuracy – 98,94).

While the model consider variety of a single IVF center, the represented approach can be used as a part of clinically important decision-making tool. Further prospective research is needed.