European Summit on PEDIATRIC NEONATOLOGY AND GYNAECOLOGY

June 12, 2019 Paris, France



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Artificial Intelligence and amniotic fluid multiomics analysis: The prediction of perinatal outcome in asymptomatic short cervix

Objective: To evaluate the utility of Artificial Intelligence i.e. Deep Learning (DL) and other machine learning techniques for the prediction of important pregnancy outcomes in asymptomatic short Cervical Length (CL).

Method: The Amniotic Fluid (AF) had been obtained from second trimester patients with asymptomatic short CL (<15 mm). CL, funneling and the presence of AF 'sludge' were assessed in all cases. Combined targeted metabolomic and proteomic analysis of AF was performed. A combination of liquid Chromatography-Mass spectrometry (LC-MS-MS) and proton Nuclear Mass Spectrometry (1H-NMR) based metabolomics and targeted proteomics analysis Bioplex Human cytokine Group-1 assay (Bio-Rad) consisting of chemokines, cytokines and growth factors, were performed on the AF samples. To determine the robustness of the markers we used multiple machine learning techniques including deep learning (DL) to predict moderate prematurity, <34 weeks, latency period prior to delivery, and NICU stay. We used standard logistic regression in addition. Omics biomarkers were evaluated alone and in combination with standard sonographic, clinical and demographic factors to predict outcome. Predictive accuracy was calculated using area under the receiver operating characteristics curve (AUC) and 95% CI, sensitivity and specificity values.

Results: Of a total of 32 patients in the study, complete omics analysis, demographic and clinical data and outcomes information was available in 26. Of these 11 (42.3%) of patients delivered at \geq 34 weeks while 15

(57.7%) delivered < 34 weeks. There was no statistically significant difference in the CL (mean /SD CL 11.2 (4.40) mm versus 8.9 (5.30) mm, p=0.31. DL had an AUC (95%CI) of 0.89 (0.81-0.97) for delivery < 34 weeks' gestation, 0.89 (0.79-0.99) for delivery < 28 days post -amniocentesis and 0.792 (0. 70-0.89) for NICU stay. These values were overall higher than for the other five machine learning methods. Each ML technique individually yielded statistically significantly prediction of the different perinatal outcomes.

Conclusions: This is the first report using AI combined with proteomics, metabolomics and ultrasound assessment. Good to excellent prediction of important perinatal outcomes were achieved in asymptomatic mid-trimester CL shortening.

Biography: Buket Aydas is an Assistant Professor of Computer Science in the Mathematics and Computer Science Department at the Albion College, USA. She earned a Ph.D. in Biomedical & Health Informatics from the University of Wisconsin-Milwaukee in 2017. Her primary research focuses on application of clinical research informatics and data analytics methodologies on medical decision-making problems. Her primary methodological and computational research interests include stochastic mathematical models, simulation, artificial intelligence, and machine learning. Buket loves exploring diverse cultures through interfaith and intercultural dialog activities. She likes traveling, hiking and reading.

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