

ii-Preliminary Study in Diagnosis and Early Prediction of Preeclampsia by Using FTIR Spectroscopy Technique

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Abstract: Preeclampsia is a heterogeneous condition, potentially involving several separate pathophysiological pathways; currently no clinical screening test is useful for prediction of preeclampsia development. Fourier-transform infrared spectroscopy (FTIR) holds great promise for clinical chemistry measurements. FTIR spectra of plasma samples from pregnant women -14 patients and 31 normotensive were obtained. Second derivative spectra, Kramer Krong refractive index and ANOVA test were tacking in comparison studies. The parameters studied were proteins and lipids. Different absorbance ratios for specific bands were calculated and plotted versus the patient samples. The absorbance IR spectra of these two groups were slightly different, but from the curve fitting analysis, the protein secondary structure compositions were significant different. The decrease in α -helix structure due to oxidative stress in patient group might be responsible of the dramatic increase in β - turns and unordered structure. Moreover, the peaks present in the IR second derivative, for patient group, at 1744cm^{-1} (cholesterol and triglycerides ester C=O), 1710cm^{-1} (carbonyl C-O stretch), and 1621cm^{-1} (peptide C=O stretch) positively correlated with low density lipoprotein (LDL) oxidation. The results showed that among the normotensive control group three subjects later developed preeclampsia. Normotensive pregnant women who developed preeclampsia were considered as subjects at high risk. This study suggests, for the first time that FT-IR spectroscopy can be successfully used as an accurate and rapid test, for diagnosis and confirmed with 33% confidence level early prediction of preeclampsia, starting from 20 week of gestation.

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Abbreviations: Fourier transform infrared spectroscopy (FTIR)

Introduction

Preeclampsia, which affects 3% to 10% of pregnancies ^[1], is a pregnancy-specific disorder characterized by hypertension, proteinuria and edema. The efforts to develop screening tests for potential use in clinical practice have yielded disappointing results ^[2]. Markers were generally chosen on the basis of specific pathophysiological abnormalities that have been reported in association with preeclampsia. Maternal concentrations of these biomarkers have been reported to be either increased or reduced early in gestation before the onset of preeclampsia. Given that preeclampsia is likely to be a heterogeneous condition, potentially involving several separate pathophysiological pathways, it is not surprising that simple clinical indicators are ineffective in identifying women who would benefit from pathway-specific treatment ^[3]. A variety of substances indicative of endothelial dysfunction are increased in the blood or urine of women with

preeclampsia ^[3, 4-5]. Many of these substances are elevated weeks before (as well as during) clinically evident preeclampsia ^[6,7]. It has been suggested that preeclampsia is a disease of antioxidant inadequacy appearing when the normal antioxidant balance is upset ^[8].

During the last decade, Fourier transform infrared (FTIR) spectroscopy has proven and accepted to be a powerful tool for the study of biological samples. The primary reason for this is that common biomolecules such as proteins, nucleic acids, and lipids, have characteristic functional groups having unique molecular vibrational modes (vibrational fingerprints) corresponding to specific infrared light frequencies ^[9,10]. The composition and structure of molecular functional groups can be determined by analyzing the position, width, and intensity of infrared light absorption ^[12-16].

In this cross sectiona study we have tested FTIR spectroscopy as a potential specific accurate