

UEMG-FHR Coupling Analysis in Pregnancies Complicated by Pre-Eclampsia and Small for Gestational Age

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Abstract : The coupling strength between uterine electromyography (UEMG) and Fetal heart rate (FHR) signals during peripartum reflects the fetal biophysical activities. Therefore, UEMG-FHR coupling characterization is instructive in assessing placenta function. This study introduced a physiological marker named elevated frequency of UEMG-FHR coupling (E-UFC) and explored its predictive value for pregnancies complicated by pre-eclampsia and small for gestational age (SGA). Placental insufficiency patients (n=12) and healthy volunteers (n=24) were recruited and participated. UEMG and FHR were recorded non-invasively by a trans-abdominal device in women at term with singleton pregnancy (32-37 weeks) from 10:00 pm to 8:00 am. The product of the wavelet coherence and the wavelet cross-spectral power between UEMG and FHR was used to weight these two effects in order to quantify the degree of the UEMG-FHR coupling. E-UFC was exacted from the resultant spectrogram by calculating the mean value of the high-coherence ($r > 0.5$) frequency band. Results showed the high-coherence between UEMG and FHR was observed in the frequency band (1/512-1/16Hz). In addition, E-UFC in placental insufficiency patients was weaker compared to healthy controls ($p < 0.001$) at group level. These findings suggested the proposed approach could be used to quantitatively characterize the fetal biophysical activities, which is beneficial for early detection of placental insufficiency and reduces the occurrence of adverse pregnancy.

Keywords : uterine electromyography, fetal heart rate, coupling analysis, wavelet analysis

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