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Real-time feto-maternal monitoring using electrical impedance approach: Hardware design and phantom study

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Objective of the study: Continuous feto-maternal monitoring with the help of electrical impedance technique.

Materials & Methods: Fetus *in situ* initiates compensatory protective mechanism which enables fetus in utero and mother to adapt to an altered state of pregnancy. It is important to predict fetus in distress during pregnancy and labor. Hence it is imperative to monitor vital parameters at a regular interval (fetal movement and uterine contractions) throughout pregnancy and during labor for an optimal pregnancy outcome. The standard methods cardiotocogram and Ultrasound are not suitable for long term monitoring fetal movement because they are bulky, expensive, time consuming and need skilled personnel. We proposed an appropriate and affordable, point of care feto-maternal monitoring system during labor and pregnancy for better pregnancy outcome. Accordingly, an effort has been made to develop an electrical conductivity based affordable screening tool for use by the health workers to monitor the vital physiological parameter such as fetal movements. A laboratory prototype system-has been developed to check the field distribution in a closed object such as fetus. This system measures the boundary potential voltages around various phantoms. Pictorial representation of current distribution and equi-potential lines on the surface of the cell contains homogenous electrolyte solution. The high frequency low current is applied between I1 and I2 electrodes which get uniformly distributed and the resulting voltage hence impedance is measured between V1 and V2 electrodes and another figure shows the general block diagram of experimental setup. Initially some preliminary work was carried out by conducting experiments on phantoms. The work was validated by conducting some experiments by taking papaya and plastic box as phantom. Experiments on few volunteers' non-pregnant human beings were also conducted to check the safety of electrical impedance instrument.

Results: The designed system is tested with different conducting and non conducting objects under different conditions. The same instrument has been tested on human volunteers to check the feasibility. Useful results were obtained.

Conclusion: Advanced theoretical and experimental studies will be carried out to develop and standardized the instrumentation. The actual clinical applicability shall be checked at later stages during clinical trials (on human and animals). The experiments will be conducted on pregnant women for the clinical trials to establish the relationship between uterine contractions, fetal movement and immature fetal autonomic nervous system from the recorded data. The new technique being proposed in this work is non-invasive, user friendly, economical and for mass health care which can be used by the poor community and the basic health worker.

Biography

Sharvan Kumar Pahuja has completed his PhD from IIT Delhi, India in the field of Feto-Maternal Monitoring. He is the Associate Professor at Dr B R Ambedkar NIT Jalandhar in ICE Department. He has published more than 25 papers in the international conference and reputed journal.

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