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R&D DIGEST

Labor Monitor Makes Delivery Less Risky

Maria Fontanazza

A device that analyzes uterine contractions might not take the labor out of delivering a baby, but it could make the process less risky and reduce complications. The technology uses electrodes and a bioamplifier to distinguish preterm labor from false labor, monitor contraction efficiency, and identify the urgency for a cesarean section.

The labor monitor identifies contraction efficiency, distinguishes preterm from false labor, and analyzes the urgency of a cesarean section.

Developed at the University of Florida (UF; Gainesville), the noninvasive device consists of an electrode mesh that is placed across the mother's belly. The 3-cm square electrodes are hooked up to a multichannel bioamplifier. Complex signal processing algorithms analyze the uterine contractions in real time.

"Our overall vision is to get everything we need from the electrodes that we put on the mom's belly," says Tammy Euliano, MD, associate professor of anesthesiology, obstetrics, and gynecology at UF. The electrodes provide information about a baby's condition and the progress of labor.

Technologies such as an electrohysterogram examine the electrical activity of the uterus, but many use only one or a few electrodes. The device developed at UF uses 10 electrodes and maps the motion of uterine activity over time.

"Imagine trying to push a golf ball out of a partially inflated balloon," explains Euliano. "The pressure you can generate in the balloon is not as important as the direction and motion of the pressure. Ideally, the contraction should start at the top of the uterus and progress downward. These spatiotemporal patterns indicate the effectiveness of the contractions to deliver the fetus, not just their ability to generate IUP [intrauterine pressure]."

Euliano says the device's ability to distinguish preterm labor contractions from an irritated uterus is a tremendous advance. If this situation arises, the mother could have the advantage of going to a hospital that can properly care for a premature baby.

The small device plugs directly into an existing fetal monitor. The advantage of such a system is that hospitals don't need to invest in yet another large monitoring system, and clinicians still get valuable information. The team is also exploring the idea of making the device wireless, so the mother would not have to be strapped to a bed to be monitored. Euliano suggests that a future version could also be waterproof, allowing a mother to shower during observation.

Although the device might take up a bit more space than current systems, there would no longer be a need for the uncomfortable circumferential straps that hold the monitors in place on the

patient. After a bit of redesign, the new system should consist of a single strip of electrodes that stick onto the abdomen. The strip needs to be either adjustable or available in different dimensions to accommodate a range of belly sizes.

The researchers are currently reanalyzing data to find the optimal number of electrodes. Euliano estimates they'll need no less than six for clinicians to see the entire uterus.

The amplifier design must be improved to reduce excessive noise—mainly muscle noise. More clinical studies are also needed to demonstrate the system's efficacy and utility. The researchers have already used the device on more than 600 patients, most of whom have found the sticker electrodes to be more comfortable than conventional straps, according to Euliano.

The device could also be altered for home use in patients who experience several false alarms. Euliano speculates that the device's packaging, which would include a mechanism to contact a hospital, would be slightly different from the hospital version, but the electrode arrays in both systems would be similar.

Convergent Engineering, a small development company in Gainesville, is producing some of the device components during the research stage but won't be involved in commercializing the device. Euliano says the company would eventually like to partner with a large medical device company to help them get the product on the market.

The researchers received funding from the National Science Foundation and the Small Business Innovation Research Program, which ended about a year ago. They're continuing to apply for more funding from the science foundation and the National Institutes of Health.