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Article published Dec 26, 2004

UF doctors help develop fetal heart monitor

A new-generation fetal heart monitor now in development could give a better picture of an unborn baby's well-being during labor than ultrasound, University of Florida physicians say.

When an ultrasound monitor is used to track the fetal heart rate, the sonar-like system must separate the baby's heartbeat from a jumble of sounds from the mother's body. The results can be misleading.

That's why UF doctors are working with a private engineering firm to develop a monitoring system that could noninvasively detect electrical activity in the baby's heart, producing a fetal electrocardiogram, or EKG.

"There have been preliminary studies that say fetal EKG is a more accurate predictor (than ultrasound) of how the baby is doing during labor," said Dr. Tammy Euliano, a UF associate professor of anesthesiology, and obstetrics and gynecology.

Euliano said currently the only way to collect that information is through a scalp electrode, a thin wire placed into the baby's scalp during labor.

The scalp electrode can only be used during the final stages of labor, however.

Euliano is working with her husband, Neil, who heads Convergent Engineering, a Gainesville-based biomedical engineering company, to develop a better system.

That system uses sensors placed on the mother's abdomen to monitor the fetal heartbeat during labor, or even earlier for mothers with health conditions such as diabetes or heart disease that place their babies at greater risk of complications.

The EKG sensors are not affected by the mother's movement or her body fat, as can be the case with the belts used for ultrasound monitors. But both systems must deal with the problem of separating the baby's heartbeat from incoming signals that can include uterine contractions, the mother's heartbeat or muscle movement.

To refine the noninvasive EKG system during the next few years, the research team will monitor hundreds of patients with both the new system and ultrasound monitors, to compare the two systems.

At the heart of the new system is a complex mathematical program called MERMAID (or Minimum Renyi's Mutual Information) that sorts data from multiple sources faster and more efficiently than its competition, Neil Euliano said.

Developed by Jose Principe, a UF distinguished professor of electrical and computer engineering, and his students, the program has proven 60 percent more reliable in isolating fetal and maternal heart rate than one popular data-sorting program and 30 percent better than another.

Tammy Euliano said she hopes that the new system, once perfected, will help reduce the number of Caesarean deliveries, which have increased dramatically since ultrasound was introduced in the 1960s.

That hope is echoed by Dr. Rodney Edwards, a UF assistant professor of obstetrics and gynecology and member of the research team.

"When this (ultrasound) system was adopted, the Caesarian delivery rate in the United States was about 5 percent," Edwards said. "Largely due to increases in deliveries because of abnormal heart rate patterns, the rate is now in excess of 25 percent.

"The goal of our project is to find something in the electrocardiogram that will help us improve outcomes," he said.
