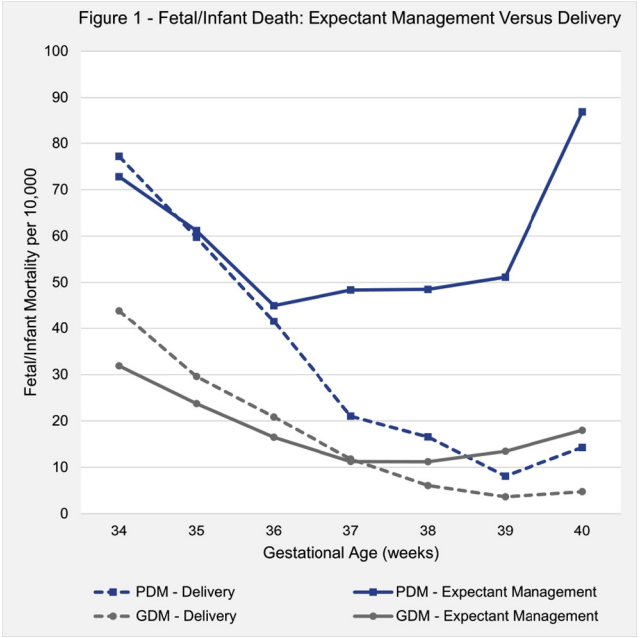


974 Non-invasive transabdominal assessment of In-Utero fetal oxygen saturation in a hypoxic lamb model

Kourosh Vali[1], Begum Kasap[2], Weitai Qian[2], Christina M. Theodorou[3], Tailai Lihe[2], Daniel D. Fong[1], Christopher D. Pivetti[4], Edwin S. Kulubya[3], Kaeli J. Yamashiro[4], Aijun Wang[5], M. Austin Johnson[6], Herman L. Hedriana[4], Diana L. Farmer[3], Soheil Ghiasi[1]

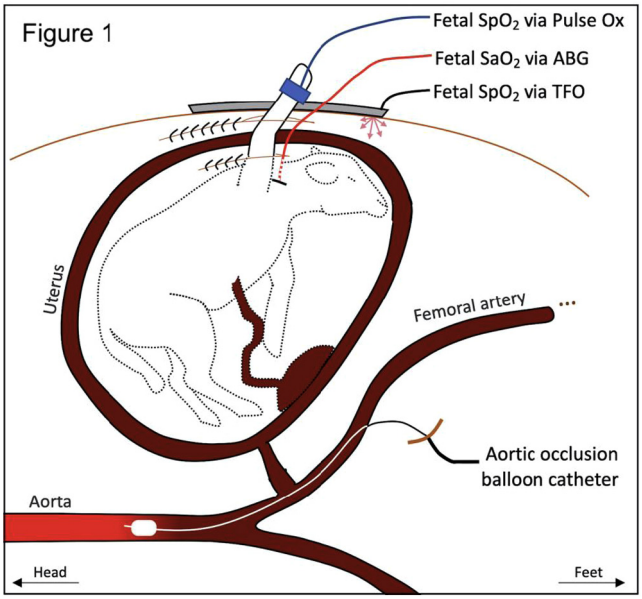
[1]University of California Davis, Davis, CA, [2]UC Davis College of Engineering, Davis, CA, [3]UC Davis Medical Center, Sacramento, CA, [4]University of California Davis Health, Sacramento, CA, [5]University of California, Davis, Sacramento, CA, [6]University of Utah Health, Salt Lake City, UT

OBJECTIVE: Fetal heart rate monitoring is a poor predictor of fetal hypoxia due to its high false-positive rate. Utilizing a novel transabdominal fetal pulse oximeter (TFO), this study aimed to demonstrate the feasibility of non-invasive and direct assessment of fetal arterial blood oxygen saturation in-utero (SaO2) in a hypoxic lamb model.

STUDY DESIGN: Fetal hypoxia was induced in 3 gravid term ewes (137.3±3.2 days gestation) by placing an inflatable balloon catheter in the infrarenal aorta via the common femoral artery (Fig 1). A fetal carotid arterial line was placed for continuous hemodynamic monitoring and arterial blood gases (ABG). The uterus was closed around the right fetal forelimb, and the laparotomy was closed, leaving the limb exposed for conventional pulse oximetry. The fetus's depth from the ewe's skin was determined, and the TFO device was placed on the ewe's abdomen. The aortic balloon catheter was inflated in a stepwise fashion to decrease the ewe's distal mean arterial pressure (dMAP) in 5mmHg increments. At each step, dMAP was maintained for 10 min, and fetal ABGs were recorded at 2.5, 5, and 10-min marks. The balloon was fully deflated after two consecutive measurements of fetal SaO2 <15%. The fetus was recovered for 45 min, and the stepwise gradient was repeated for a second round. At each dMAP level, the average fetal oxygen saturation measured by the TFO (SpO2) was compared to the average fetal SaO2.

RESULTS: TFO measurements of fetal SpO2 were compared to fetal SaO2 (Fig 2A) and were found to be highly correlative (R=0.64 and p<0.0001) (Fig 2B). The ex-utero conventional clinical pulse oximeter readings from the exposed forelimb had a weak correlation with fetal SaO2 (R=0.16 and p<0.0003). Fetal depth, composed of ewe's abdominal wall and uterine wall thickness, was 15.0±4.3mm (SD).

CONCLUSION: The novel TFO device can measure fetal SaO2 based on the high correlation of SpO2 and SaO2 despite intervening maternal anatomy. TFO can potentially improve the accuracy of fetal hypoxia detection. Future research will focus on intrapartum validation in lamb models and human pregnancies.



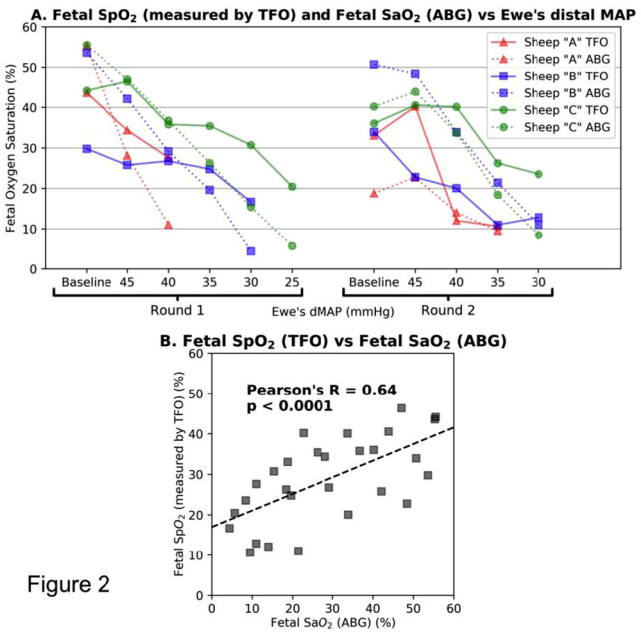


Figure 2