REPRODUCTIVE BIOLOGY

ORIGINAL RESEARCH

Application of clinical indices of fetal growth and wellbeing to a novel laboratory species, the spiny mouse

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SUMMARY

Ultrasound was used to measure growth of the spiny mouse fetus throughout gestation and to record Doppler measurements of heart rate and umbilical blood flow to monitor fetal blood supply and wellbeing. Female spiny mice were anesthetized on 6 occasions throughout pregnancy. Ultrasound was performed with a Philips HDI 5000 machine using a compact linear CL15-7 transducer. Fetal heart rate and growth parameters increased across gestation. Blood flow through the umbilical artery and vein showed increasing velocity over gestation, and reduced resistance index. Blood flow through the ductus venosus also increased in velocity over gestation; however the resistance index remained constant. We have determined changes in umbilical blood flow throughout pregnancy in the spiny mouse, which resemble those seen in human pregnancy. We also confirm that ultrasound can be used as a valuable, non-invasive technique

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for measuring fetal growth and wellbeing in the spiny mouse. *Reproductive Biology 2008, **8**, 3:229-243.*
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INTRODUCTION

While ultrasound has long been a valuable tool in obstetrics and gynecology to monitor the growth and wellbeing of the human fetus, it is only recently that such technologies are being applied to animal based research. Higher frequency imaging has recently become available, making it possible to accurately image the small animal. *In utero* ultrasound technology has been utilized in a variety of animal models including, sheep [1, 29], rats [16] and dogs [9]. Further, the use of high frequency ultrasound has been reported and described in many mouse studies of pregnancy and development [3, 18-20, 23, 26-28, 31].

Given the need to understand fetal growth and placental function, and the wide range of perinatal models (non-human primates, sheep, guinea pigs, rats, mice) being used to study effects on these, it is necessary to apply clinically relevant measures of fetal growth and wellbeing to accurately assess the effects of any treatments likely to alter fetal growth and wellbeing. While measurements of fetal and placental growth have been well documented in conventional rodents, few have measured umbilical blood flow. In those studies where umbilical blood flow measurements were taken, these values do not represent that seen during human pregnancy. Therefore we proposed to measure umbilical blood flow, as well as ductus venous flow in a precocial rodent species, the spiny mouse, where development of major organ systems reflects that seen in newborn humans. We hypothesized that late gestation blood flow would be similar in spiny mouse and human pregnancy, further highlighting the appropriateness of the spiny mouse as a model for fetal and perinatal studies.

The spiny mouse is a small rodent species currently being characterized and used as a model for fetal and neonatal studies. The spiny mouse is proving to be valuable in the study of fetal and placental growth and function