Conclusion: We show that it is possible to extract sufficient data from whole-placenta micro-CT imaging to simulate function from macro- to micro-scale. By analysing how quantitative measures of feto-placental vascular branching derived from micro-CT impact on total placental resistance and placental blood flow heterogeneity we are able to demonstrate that in normal placentae, asymmetry in vascular branching is likely to result in a balance between a large gas exchange surface area, and a low vascular resistance.

P2.56.
MAGNETIC RESONANCE ASSESSMENT OF THE EFFECT OF MATERNAL POSITION ON FETOPLACENTAL BLOOD FLOW AND OXYGENATION

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Objectives: Maternal supine sleep position is associated with increased risk of late stillbirth. Our previous studies showed 16.4% reduction in maternal cardiac output, and 32% reduction in abdominal aortic blood flow in healthy pregnancy when the woman lay supine, compared to left lateral, suggesting a potentially reduced delivery of maternal blood to the placenta. However, the impact of maternal position on placental function is unclear. This study aims to determine whether maternal position in late gestation impacts on placental blood flow and oxygenation.

Methods: Ten women with uncomplicated pregnancies were recruited for imaging at 34-38 weeks. Magnetic resonance imaging (MRI) phase contrast, T2 and diffusion weighted sequences were used to study internal iliac artery and umbilical venous flow, placental blood flow and oxygen saturation when the mother lay in left lateral decubitus and supine positions. Ethical approval was obtained from the University of Auckland Human Participants Ethics Committee.

Results: Compared with left lateral decubitus, volumetric flow in reduced when supine by 14% in right and 21% in left maternal internal iliac arteries, and 16% in the umbilical vein. Subjects showed a trend for reduced diffusivity within the placenta when supine, consistent with these changes in volumetric blood flow. However, there were no consistent changes in fetal oxygenation between positions, and changes in imaged placental oxygen saturation were small.

Conclusion: This is the first MRI study to describe the effect of maternal position in late pregnancy on maternal and feto-placental blood flow and oxygenation. Our study suggests that fetal oxygenation remains relatively consistent between left lateral decubitus and supine positions despite significant reduction in maternal and placental blood flow when supine. Trends suggest a potential fetal compensatory mechanism to reduced maternal flow within the uteroplacental circulation, with fetal flow rates reducing to match reductions in maternal blood flow in normal pregnancies.

P2.57.
AI-BASED RAPID PLACENTAL ASSESSMENT TOOL

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Objectives: Placentas are tremendously useful in clinical care but the current system relies on placental pathology exams which are costly, have a lengthy multi-phase process, and require high-level training of a
pathologist. Our objective was to test the use of artificial intelligence (AI) to automatically capture and translate data from photographs to create a rapid tool to assess all placentas at birth.

**Methods:** We curated a dataset from pathology reports and maternal/fetal side photographs from Northwestern Memorial Hospital (n=2541). We used natural language processing to create variables for descriptors and diagnoses from paragraph-form reports. We then used deep learning and statistical clustering-based AI techniques to create a computational pipeline that 1) segments disc and cord; 2) takes morphological measurements; and 3) predicts pathological diagnoses. We used pathology reports or hand tracing as the ground truth; 80% of the dataset was training and 20% was testing.

**Results:** Mean (SD) maternal age was 32 (5) years and placental weight was 439 (113) g. Twenty percent were preterm. Mean pixel-accuracy for segmenting disc color, area, and contour/shape and cord insertion point, diameter, and coils. From these visual features, we predicted the following five diagnoses (accuracy): marginal cord insertion (97.6%), irregular shape (94.5%), hypercoiled cord (88.2%), abruption (78.2%), and meconium (76.4%). We also had promising results for classifying incomplete maternal surface (sensitivity=82.6%, specificity=70.7%).

**Conclusion:** We have developed a preliminary system to automate placental assessment from photographs. We aim to expand this tool to become a rapid, simple assessment for all placentas to provide information for clinical care right after delivery and to triage placentas for full pathology exams.

**P2.58.**

**SPATIAL T2* MRI MEASURES AS A MARKER OF OXYGENATION – ASSESSMENT IN HEALTHY PREGNANCIES OVER GESTATION**

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**Objectives:** Placental insufficiency is a leading cause for major pregnancy complications such as fetal growth restriction and pre-eclampsia, making early identification crucial. MRI-based T2* relaxometry as an in-vivo marker of oxygenation is increasingly used—but was limited so far to whole volume analysis. We present a T2*-based histogram asymmetry measure to assess spatial distribution.

**Methods:** 71 women with uncomplicated pregnancies, GA=21+5-38+2 weeks (mean 29+6 weeks), had an in-vivo MRI Multi-Echo-Gradient-Echo scan (3mm3 resolution, 4 echo times, 30sec acquisition time) on a clinical 3T-scanner. T2* maps and mean were obtained. The proposed histogram asymmetry measure (HAM) was calculated as the fraction of placental tissue above 10% of the mean value.

**Results:** The T2* maps show clear spatial distribution of bright (high T2*) centres in each lobule surrounded by increasingly darker (lower T2*) spheres. Over gestation, the lobularity becomes more pronounced, with smaller bright high T2*centres and a faster decay of T2* in the spheres. T2* mean results show a linear decay over gestation with 3.45ms decrease per week. The histograms show a left and upward shift, corresponding to a reduced area of high T2* and a growing area of low T2* values. The HAM measure remains roughly 1 until 32 weeks gestation for most subjects and drops consistently in the last 8 weeks of gestation. A weak correlation between drop in HAM and birth weight centile can be observed.

**Conclusion:** The bi-phase behaviour of T2* HAM could be indicative of the placenta reaching its reserve capacity in the final weeks of pregnancy. It corresponds well to the visual observation of increased lobularity in the T2*. Next steps will include the systematic evaluation of the HAM measure in data from women diagnosed with growth restriction and pre-eclampsia.