OC18: STATE-OF-THE-ART TECHNIQUES TO IMAGE THE FETUS

OC18.01

Fetal enhanced tridimensional and translational anatomical landscape: FETTAL Project

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Objectives: FETTAL Project aim to establish a Fetal Enhanced Tridimensional and Translational Anatomical Landscape using high-resolution imaging such as Micro-CT or Micro-MRI.

Methods: FETTAL Project obtains French ethics authorisation since April 2015. We collected samples that came from abortion and early miscarriage, between 3 and 12 weeks of gestation, after informed consent of pregnant women. Samples were macroscopically examined to exclude any malformation or expulsion's lesion. Included samples were fixed with formaldehyde 4%. Then, they were scan with Microtomograph Skyscan* 1076 from Bruckner* in ISEM - Montpellier RIO Imaging and / or with high resolutive MRI Agilent* Varian 9,4T in BioNanoNMRI. Imaging post treatment was done with Myrian* and ImageJ*.

Results: Since January 2016, we had 25 consents. 18 cases were excluded because of partial abortion (7 cases), fragmented samples (7 cases), no embryonic development (4 cases). Seven samples (28%) were included in the imaging group: 3 samples had only Micro-CT, 1 only Micro-MRI, 3 samples both Micro-CT and Micro-MRI. First, we obtained Micro-CT tridimensional volume at various Carnegie stage. Then, Micro-MRI post treatment and segmentation allowed us to obtain a vascular tree at 5 WG and an embryonic heart at 7+2 WG. Finally, Micro-CT up to 9WG show embryonic skeleton.

Conclusions: High-resolution technologies such as Micro-CT and Micro-MRI are simple non-destructive way to get a precise tridimensional anatomical landscape. Our goal is to improve the understanding of human development, to construct an educational support and to prepare the future with virtual autopsy.

Supporting information can be found in the online version of this abstract

OC18.02

Magnetic resonance imaging (MRI) T1 relaxation properties of fetal blood in normal and in suspected anemic fetuses

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Objectives: MRI T1 relaxation time is inversely proportional to haemoglobin (Hb) level in the blood. Our aim was to investigate the ability of T1 relaxation time to predict fetal anemia.

Methods: Normal fetuses and fetuses suspected of anemia (PSV in MCA > 1.5 MoM) due to Rh alloimmunisation or twin anemia-polycythemia sequence were scanned in a 1.5T Siemens MRI scanner 1–5 times during pregnancy. We used a T1-mapping MOLLI sequence for a cross section scan of the umbilical vein (UV) (figure 1). We compared T1 values using the method of generalised estimating equation to account for the correlation within fetuses.

Results: In 15 normal fetuses (39 scans) T1 values were 1005–1391 ms. In 6 fetuses suspected of anemia 8 scans were performed before blood transfusion. In 6 of these scans T1 values were 1437-1591 ms and anemia was moderate to severe (Hb 1.5–5.9 mmol/L). T1 values in the remaining two scans were 1199 and 1410 ms and anemia was mild (Hb 8.6 and 7.8 mmol/L, respectively). After blood transfusions (35–110 ml) Hb levels were 8.7–9.7 mmol/L in all cases and T1 values dropped to 1095–1280 ms.T1 values before blood transfusion in fetuses with moderate and severe anemia were on average 245 ms higher than in normal fetuses (95%CI 176–313 ms, $P<0.001$). T1 values after blood transfusions were comparable to normal fetuses (mean -27 ms, 95%CI -98–42 ms, $p=0.439$). T1 values from all scans are presented in figure 1. A T1 value cut-off of 1425 ms would identify all fetuses with moderate and severe anemia in this study, with no false-positives.

Conclusions: T1 values in the fetal UV may be an interesting non-invasive tool for prediction of moderate and severe anemia.

Supporting information can be found in the online version of this abstract

OC18.03

*Superb microvascular imaging of the fetus, placenta and umbilical cord

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Objectives: Superb microvascular imaging (SMI) is a new Doppler technology that uses a unique algorithm to minimise motion artefacts by eliminating tissue motion (clutter), and can depict low-velocity blood flow in small vessels due to significantly reducing motion artefacts. We present our experience of using SMI to assess fetal organ vasculature, placental vascularity, and umbilical cord.

Methods: Fetal organ vasculature, placental vascularity, and umbilical cord were assessed using the SMI (Aplio i900/800, Toshiba Medical System, Tokyo, Japan) with a high-resolution probe in 7 normal and one fetal growth restriction (FGR) pregnancies at 11–33 weeks of gestation.

Results: Fetal intracranial, pulmonary, splenic, renal, and intercostal vessels were clearly depicted. In the first trimester placenta, the primary and secondary stem villous vessels, and spiral artery jet flow were noted. In the second-and third-trimester placentas, the primary, secondary, and tertiary stem villous vessels, and whole spiral artery jet flow were clearly depicted using SMI, compared with conventional two-dimensional colour/power Doppler sonography. In the thick heterogeneous placenta with severe FGR, SMI demonstrated very sparse villous trees in the placenta, and each stem villous vessels became straight. Especially, primary stem villous vessels were thick and long (Baobab-tree-like appearance). Velamentous

*This presentation is eligible for the Young Investigator award (to be presented in the closing plenary).