Brain growth is impaired in fetuses with congenital heart disease- MR volumetric assessment of the fetal brain.

Jowett V., Allsop J., Fox M., Kyriakopoulou V., Rutherford M., Gardiner H.
Queen Charlottes Hospital, Imperial College London
London, UK

Introduction
In the current era of excellent surgical results for congenital heart disease (CHD) focus has become directed on quality of life for these children. Previous studies have shown that neurodevelopmental outcome in CHD is impaired. The mechanisms for this are complex and not well understood but there is increasing evidence that the origins of this are in fetal life. We aimed to describe the in utero brain growth in a cohort of fetuses with CHD and relate this to the circulatory abnormalities on fetal echo.

Methods
Pregnant women with a fetus with CHD were prospectively recruited in a fetal medicine centre. The congenital heart defect was phenotyped using fetal echocardiography and patients subdivided into 5 physiological groups: Left heart obstructive lesions with forward flow (1) and reversed flow (2) in the transverse arch, Right heart obstructive lesions (3), Transposition of the great arteries (4), Shunt lesions (5).

Fetal brain MRI was performed. In addition to biometric measurements SVR (snapshot to volume reconstruction) was used to construct a 3D data set from the oversampled raw data. From these 3D volumes the total brain volume and ventricular volumes were measured by manual segmentation.

12 patients had a second MRI scan in pregnancy.

Results
31 women were recruited who had a fetus with CHD. Comparison was made with 53 normal controls. The median gestational age of the CHD cohort when analysed by the last scan in pregnancy was 28.5 and 29.3 weeks in controls. (p= 0.83). Cases and controls showed a similar linear increase in biparietal diameter and transcerebellar diameter with gestation.

There was a slower rate of brain growth and smaller brain volumes in fetuses with CHD (p=0.029). Analysis by diagnostic subgroup showed a trend towards slower brain growth in all subgroups.

Conclusions
Fetuses with CHD have a slower rate of brain growth compared to normal controls. In addition to that previously described in hypoplastic left heart and transposition of the great arteries, this study suggests that there may also be differences in other congenital heart lesions. Further research into a broader spectrum of congenital heart defects is needed.