INTRODUCTION

Prenatal alcohol exposure (PAE) has serious consequences for brain development and cognitive function. To our knowledge, no DTI-tractography studies of PAE newborns have been performed.

In this preliminary study, DTI and tractography were used to analyze WM development in newborns whose mothers were recruited during pregnancy as part of the Cape Town Longitudinal FASD Study [1]. The incidence of heavy drinking during pregnancy and fetal alcohol related disorders in the local Cape Coloured (mixed ancestry) population is among the highest in the world.

RESULTS

Methods

This preliminary group includes 13 nonsedated newborns: 7 PAE and 6 HCs (characteristics in Table 1; mothers only differed in education and in alcohol consumption). A timeline follow-back maternal interview was administered antenatally to ascertain alcohol use during pregnancy [3]. Women averaging ≥2 oz absolute alcohol (AA)/day (≥2 standard drinks/day), or ≥2 binges (≥2 standard drinks/occasion) were invited to participate. Women initiating antenatal care who drank <0.5 oz AA/day and did not binge drink were invited as controls. Exposed newborns were born to mothers who drank >8 drinks/day during pregnancy around time of conception.

Scanning was performed on a 3T Siemens Allegra using a custom-built, 170.9mm (inner diameter) circularly polarized birdcage RF coil. Two DWI sets were acquired using opposite phase encoding directives with a twice-refocused SE-EPI sequence: TR/TE = 1000/90 ms; 2x2x2mm; 30 DWI gradients, b=1000s/mm²; 5 b=0 scans. Data were inspected for motion and dropout slices, with individual volumes discarded (>20 DWIs remained in all cases), and were motion corrected using FSL and susceptibility-distortion correction.

Wholebrain structural properties were investigated. FA was typically lower in the PAE group than in the HC group across pregnancy from models including GA as an additional regressor are shown in Fig. 3. As expected, GA effects (not shown) were significant in many cases, but were independent of and did not alter alcohol effects. RM-MANCs did not show significant interaction effects between region and GA or gender.

WM regions were found connecting several ROIs. Those were selected for further analysis which appeared symmetrically in all subjects: for A, four sets; and for B, six sets in each hemisphere (reference locations and numbers in Fig. 1). Examples of WM locations found with probabilistic tractography are shown in Fig. 2. A comparison of mean DTI parameter values for the HC and PAE groups are shown in Table 2 for the CC WM and for each of the L and R association regions. MD and L1 were consistently higher in HC, while PD lower. T1 was approx. equal or higher in HC. HC FA was significantly lower in the L association region.

CONCLUSIONS

• AA/occasion at conception and AA/day across pregnancy were strongly related to MD and L1 in several WM association regions, particularly in the more posterior association fibers.

• In the CC, the genu showed a significant relation between alcohol at time of conception and L1. Interestingly, FA was typically higher in the PAE group, and MD, L1 and RD all lower.

These relations in isolation might suggest faster development in the PAE brains; however, that group also tended to have higher PD values, denoting higher water content. In this age range, a decrease in PD can be associated with chemical maturation of myelin, suggesting that this process has been slowed down in PAE subjects. In the association fibers, the posterior regions generally showed the most statistical significance, and in the CC, the genu in the anterior.

REFERENCES