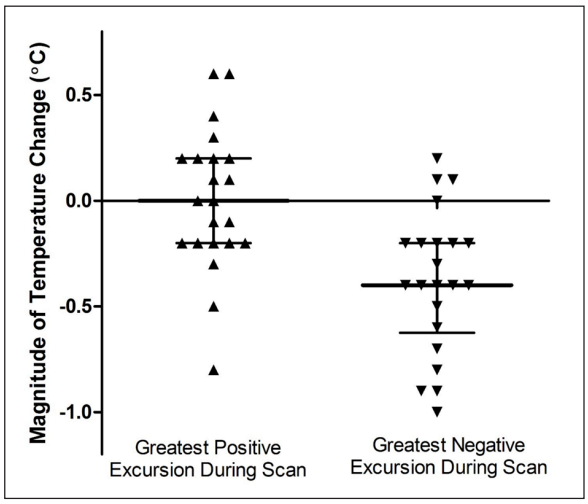

Figure 1 (ABS 55). Deviation of temperature from baseline during MR (all infants).

ABS 56

STRUCTURED REPORTING IN HYPOXIC-ISCHEMIC ENCEPHALOPATHY – BENEFICIAL FOR THE RADIOLOGIST AND THE CLINICIAN

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INTRODUCTION

The radiology report is a tool to communicate information to the referring physician and record data for follow-up or research purposes. With structured reporting templates this information becomes uniform, comprehensive and easily manageable. In collaboration with neonatologists and information technologists we developed a structured MRI reporting template for neonatal hypoxic-ischemic encephalopathy (HIE).

PATIENTS AND METHODS

To enable the development of a systematic reporting template, fifty term neonates with the clinical diagnosis of perinatal asphyxia were enrolled in a retrospective analysis. The selected MRI studies performed with a Philips Achieva 3T MR scanner between 2007 and 2014 were re-evaluated and compared to the clinical findings and literature data. Based on the clinical question, previous literature, and our own key findings on T1-, T2-, T2*/SWI-, diffusion-weighted MR images and single voxel MR-spectroscopy an "easy walk through" reporting template was created in a web-based framework. In a feasibility study, we reported 10 neonates through the template as an initial test of the system.

RESULTS

The proposed structured reporting outline follows a tree structure, it is organized around key structures and key modalities to direct focus on the most characteristic imaging findings seen in neonatal HIE. Although the full reporting template consists of about 350 questions, only the relevant headings and subheadings are to be filled as the report progresses. The first section of the template is composed of patient data and the technical aspects of the MRI examination. The second part records signal intensity changes in 82 nested anatomic landmarks and vascular territories. The central or peripheral pattern of the injury and the possible concomitant findings as hemorrhage or infarction can also be recorded. The feasability study of 10 neonates showed that the working version of the template provided a precise but also quick and easy way to record the imaging findings.

CONCLUSIONS

Here we introduced a novel structured reporting template for MRI examinations in HIE. The proposed template is not only useful for the radiologist, but it is beneficial from the clinical, research and administrative point of view. Besides promoting radiologists' accuracy with a standardized format and expressions, the proposed structured reporting template may reduce interpretation ambiguity for the clinicians, hence it may have a direct positive impact on patient care.

ABS 57

DIFFUSE OPTICAL IMAGING OF RESTING STATE FUNCTIONAL CONNECTIVITY IN INFANTS

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INTRODUCTION

The growing number of surviving preterm infants has led to an emerging public health problem as these children face lifelong disability. Subtle changes of preterm brain injury can be missed by conventional structural brain-imaging. Functional imaging, such as Diffuse Optical Imaging (DOI) can be used to evaluate spontaneous brain activity known as resting state functional connectivity (RSFC) as a biomarker of brain development. DOI is safe, non-invasive and uses near-infrared light to measure cerebral haemodynamics to evaluate RSFC images. Identifying atypical development of RSFC at an early stage could facilitate timely neuroprotective strategies to optimise neurodevelopmental potential.

PATIENTS AND METHODS

The NTS DOI system (Gowerlabs, London, UK) was used to study RSFC in the developing brain. Using a soft, flexible cap (EasyCap, Germany) we have been able to apply a dense array of DOI sensors over the temporal and sensorimotor regions of the head of newborn infants. 19 healthy term infants were recruited for DOI scans. Infants were scanned while asleep for 1 hour in the Evelyn Perinatal Imaging Centre, Rosie Hospital, Cambridge. DOI images of oxyhaemoglobin

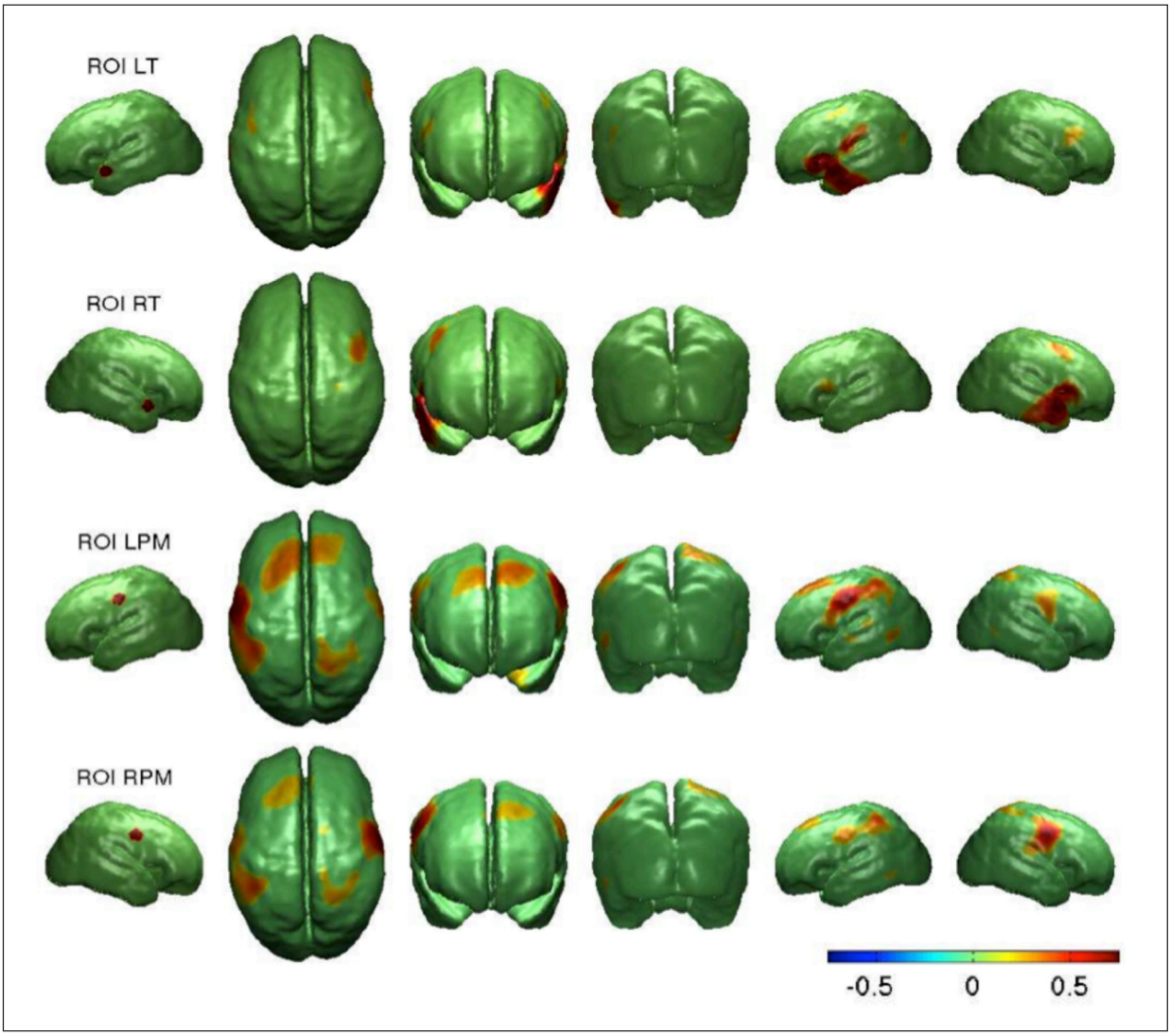

Figure 1 (ABS 57). Group images from n = 15 subjects. The first column indicates the location of the "region of interest" in red (ROI). Correlated regions are highlighted in orange-red colour along the corresponding row (colour threshold r > 0.2, colour bar is located at bottom right corner of figure). The image views for each column are: 2nd = caudal; 3rd = frontal, 4th = occipital, 5th = left temporal, 6th = right temporal. LT: left temporal; RT: right temporal; LPM: left premotor; RPM: right premotor.

concentration changes were reconstructed using an age appropriate neonatal head atlas and a multispectral approach with the TOAST forward modelling and image reconstruction package. Functionally connected brain regions demonstrating correlating slow changes of oxyhaemoglobin were identified to create RSFC image maps.

RESULTS

DOI images were reconstructed from a total of 15 subjects (median gestational age at birth: 40 weeks) (**Fig. 1**). DOI scans were performed within the first week of life (mean: 2 days). Four subjects were excluded due to motion artifacts in their data. Seed-based analysis and Pearson's cross correlation coefficient r were used to identify RSFC temporal and premotor networks in the RSFC frequency range (0.009-0.08 Hz). Correlation coefficient r-values were normalised using the Fisher Z transformation for group analysis. The inverse mean Z-scores produced mean r-values that were used to create group RSFC image maps. Group analysis revealed images resembling bilateral RSFC networks between homotopic temporal and premotor regions.

CONCLUSIONS

Our results demonstrate the potential use of DOI as a clinical neuroimaging tool. Our next step is to develop a robust biomarker of brain function by combining DOI RSFC with resting-state EEG and imaging in preterm infants longitudinally to complement clinical assessment of infant neurobehaviour and long-term outcomes.

ABS 58

IN VIVO ASSESSMENT OF CEREBRO-CEREBELLAR CONNECTIVITY IN THE DEVELOPING BRAIN USING HIGH ANGULAR RESOLUTION DIFFUSION IMAGING

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INTRODUCTION

The cerebellum grows rapidly during gestation, and is particularly vulnerable during this critical developmental period. The cerebellar hemispheres are connected to contra-lateral cerebral cortices. Abnormalities in these pathways may underpin a range of neurocognitive and neurobehavioral deficits. Delineating these pathways *in vivo*, however, is challenging. The aim of our study was to assess the feasibility of delineating cerebello-thalamo-cortical (CTC) and cortico-ponto-cerebellar CPC) pathways during early developmental stages using *in vivo* high angular resolution diffusion imaging (HARDI) analysed with contrained spherical deconvolution (CSD).

PATIENTS AND METHODS

MPRAGE, T2 weighted imaging and HARDI data were acquired in 24 infants on a 3T Philips Achieva MRI system sited on the neonatal intensive care unit. Median (range) gestational age of the infants was 33^{+4} (24^{+6}-39) weeks. Imaging was performed at a median age of 37^{+4} (29^{+1}-44) weeks post-menstrual age (PMA). HARDI data was acquired using 64 diffusion-encoding gradients, b-value 2,500 s/mm², and 4 non-diffusion weighted images, voxel size 1.75 x 1.75 x 2 mm. TR and TE were 9,000 and 62 milliseconds respectively. T2 weighted images were parcellated into 90 regions using elastic registration to a neonatal specific atlas. The fibre orientation distribution in each voxel was estimated using CSD and probabilistic tractography was performed using MRtrix.

RESULTS

Connections between cerebellum and contralateral cerebral hemisphere were identified in all infants studied (**Fig. 1**). Fractional anisotropy (FA) values of CTC and CPC pathways significantly increased with PMA at scan ($p < 0.001$). Regions with the highest percentage of streamlines connecting with the cerebellum through CTC and CPC pathways were: right and left pre-central gyrus, right superior frontal gyrus, right supplementary motor area, right and left postcentral gyrus and paracentral lobule. Regions with highest average FA connectivity were: right and left insula, right caudate and left putamen.

CONCLUSIONS

Delineating complex cerebello-cortical and cortico-cerebellar fibres and assessing development of these tracts is feasible in the immature brain *in vivo* using HARDI data analysed with CSD. The designed protocol will be useful for assessing the relationship between cerebellar structural development and subsequent cognitive and motor function.