

## High-field diffusion tensor imaging characterization of cerebral white matter injury in LPS exposed fetal sheep

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### Introduction:

In gyrencephalic species such as sheep, precise anatomical and microstructural characterization of the consequences of fetal inflammation is important for the comprehension of perinatal brain injury mechanisms. The aim of this study was to provide MRI delineation of the changes in the developing white matter (WM) following lipopolysaccharide (LPS) exposure in the 0.7 gestation fetal sheep.

### Material and Methods:

#### Animal:

- Fetal sheep at 103d of gestation (term = 145d) received vehicle (Sham) or LPS (LPS)

#### MRI:

- T<sub>1</sub>W, T<sub>2</sub>W and DTI performed.
- Gray/White matter (GM/WM) volumes and Corpus callosum (CC) thickness measured.
- Diffusivities (D<sub>⊥</sub>, D<sub>∥</sub> and MD) and fractional anisotropy (FA) quantified in the MR lesions.

#### Staining:

- AF/T, GFAP, neurofilament (NF) and amyloid precursor protein (APP).

### Results and discussion:

Total brain and WM volumes as well as CC thickness were significantly reduced following LPS exposure as already observed in human preterm [2].

MR signal abnormalities are summarized in the figure:

Lesion name	Focal/ Diffuse	MRI		DTI			Fiber disruption	Histology				Lesion Area	Human corresponding
		T <sub>1</sub> W	T <sub>2</sub> W	FA	MD	D <sub>⊥</sub>		AF/T	GFAP	NF	APP		
Diff WM lesions	Diffuse	↓	↑	↓	NC	↑	NA	↓	NC	↓	↓	Intragyr al WM	DEHSI [3]
Necrosis	Focal	↑	↓	↓	NC	↑	Moderate	↑	↓	↓	↑	Fronto- parietal PVWM	Punctate [4]
Cysts	Focal	↓↓	↑↑	↓↓	↑↑	↑↑	Severe	NA	NA	NA	NA		Cysts [5]

NC: No change, NA: not available, ↑: increase/accumulation, ↓: decrease/reduction

### Conclusion:

The combination of lesions depicted by DTI in LPS treated fetal sheep (i.e. DEHSI, punctate lesions and cysts) mimics very well the pattern of injuries seen in premature infants confirming the relevance of such a model.

**References:** [1]Hüppi PS. AoN1998; [2]Nosarti C. HBM2011; [3]Maalouf EF. JPed1999; [4]Rutherford MA. Neuroradio2010; [5]Ramenghi LA. EHD2009.

**Acknowledgements:** Supported by the Fond National Suisse, NEOBRAIN, the CIBM of the UNIL, UNIGE, HUG, CHUV, EPFL, the Leenards and Jeantet Foundation.