

## Objectives

Typical hemolytic uremic syndrome (HUS) is characterised by the triad of acute renal failure, thrombocytopenia and hemolytic anemia and in Europe is mostly caused by Shiga toxin-producing Escherichia coli (STEC). Neurological involvement is found in between 17 – 52%. Magnetic resonance imaging (MRI) may reveal abnormalities especially affecting the basal ganglia and / or thalami, but also the deep white matter. Early MRI may offer such options, as previously postulated by Donnerstag et al. [1].

We aimed to evaluate microstructural cerebral changes in children suffering from hemolytic uremic syndrome (HUS) based on apparent diffusion coefficient (ADC) maps

## Methods

In 9 pediatric HUS patients with neurological symptoms with a median age 3.0 y (0.8 - 14.6), conventional magnetic resonance imaging (cMRI) at 1.5T was retrospectively analysed. All examinations included axial diffusion weighted, single-shot, spin-echo echo planar sequences. ADC values were measured in 35 different brain regions and compared with age-related ADC reference values from previously published pediatric controls. Depending on clinical outcome our cohort was divided into 2 subgroups. Subgroup A showed devastating neurological outcome whereas subgroup B showed improvement without lasting neurological deficit.

## Results

Qualitative analysis revealed lesions on diffusion-weighted imaging (DWI) in basal ganglia and/or thalami with corresponding T2 hyperintensities in subgroup A, whereas subgroup B did not show qualitative DWI alterations even if T2 hyperintense lesions were found in these regions (Table 1). Quantitative analysis demonstrated abnormal ADC values in all HUS patients with a trend to more regions being affected in subgroup A (16 versus 10.5 respectively, median number of regions, p=0.18 (Table 2)).

Pat ID	Age (y)	Subgroup	Basal ganglia and/or thalamic alterations	
			Hyperintense T2 lesions	DWI lesions
1	1.4	A	+	+(DWI ↑, ADC ↓)
4	2.3	A	+	+(DWI ↑, ADC =)
6	7.3	A	+	+(DWI ↑, ADC ↓)
8	3	A	+	+(DWI ↑, ADC ↓)
9	0.8	A	-	-
9 FU	0.8	A	+	+(DWI ↑, ADC ↓)
2	3.5	B	+	-
3	1.8	B	-	-
5	10	B	-	-
7	14.6	B	+	-

**Table 1** Qualitative imaging findings in basal ganglia/ thalami in children with HUS:

T2 hyperintense basal ganglia/thalamic lesions with corresponding DWI alterations were only found in subgroup A with devastating neurological outcome.

Subgroup	Number of regions with altered ADC values			Number of hyperintense T2 regions
	Below	Above	Total	
A	51 (29%)	21 (12%)	72 (41%)	28
B	17 (12%)	20 (15%)	37 (27%)	5
Total A + B	68 (22%)	41 (13%)	109 (35%)	33

**Table 2** Frequencies of ADC values below and above the age-dependent reference range per HUS subgroup

## Conclusion

Using DWI images qualitative and quantitative differences were found between HUS patients with devastating neurological outcome and those without. ADC values may help to detect more extensive cerebral changes than conventional qualitative findings. Both modalities together may permit prognostic statements in pediatric HUS patients.

## References:

- Donnerstag F, Ding X, Pape L, Bultmann E, Lucke T, Zajacsek J, et al. Patterns in early diffusion-weighted MRI in children with haemolytic uraemic syndrome and CNS involvement. Eur Radiol. 2012;22:506-13.