THE PROGNOSTIC VALUE OF CEREBRAL MRI FOR NEURODEVELOPMENTAL OUTCOME IN BABIES UNDERGOING THERAPEUTIC HYPOTHERMIA FOR HYPOXIC ISCHAEMIC ENCEPHALOPATHY IN THE CLINICAL SETTING.

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INTRODUCTION:

The cooling trials have shown that babies who undergo therapeutic hypothermia (TH) for hypoxic-ischaemic encephalopathy (HIE) have fewer cerebral lesions on MRI, but if lesions were present they were still predictive of neurodevelopmental outcome (Rutherford et al, 2010).

AIM:

We aim to quantify and validate the prognostic value of neonatal cerebral MRI on neurodevelopmental outcome in a cohort of babies undergoing TH in clinical practice, outside of the clinical trials

METHODS:

Newborns who received TH for HIE and had cerebral MRI were prospectively recruited from four centres. Scans were reported by two independent, blinded experts rating basal ganglia and thalamus (BGT), posterior limb of the internal capsule (PLIC) and white matter (WM) changes (Rutherford et al, 2010) and were assigned a favourable or an unfavourable outcome (Figure 1). Neurodevelopment assessments were obtained; Bayley's Scales of Infant and Toddler Development III, with composite scores of < 85 considered unfavourable.

Figure 1: MRI scoring tool

REFERENCE: Rutherford M, Ramenghi LA, Edwards AD, et al. Assessment of brain tissue injury after moderate hypothermia in neonates with hypoxic-ischaemic encephalopathy: a nested substudy of a randomised controlled trial. *Lancet Neurol* 2010;9(1):39-45. doi: 10.1016/s1474-4422(09)70295-9

RESULTS

Figure 2: study profile

RESULTS: MRI AND ND OUTCOME

The unfavourable MRI group (n = 22) had significantly lower motor (p< 0.001), language (p < 0.001) and cognition (p < 0.001) scores on Bayley-III assessment compared with the favourable MRI group (n = 48) (Figure 3).

Figure 3: Bayley's composite scores

RESULTS: MRI PATTERNS OF INJURY AND ND OUTCOME

On multiple regression there was a significant relationship between BGT abnormality and motor, cognition and language outcomes (Figure 4)

Figure 4: Multivariate analysis

		Unstandardised coefficient	p – value
Cognitive	BGT	-12.093	p = 0.011
	PLIC	-7.117	p = 0.292
	WM	-2.190	p = 0.376
	Cortex	-1.081	p = 0.733
Language	BGT	-9.942	p = 0.013
	PLIC	-8.807	p = 0.122
	WM	-2.126	p = 0.306
	Cortex	0.285	p = 0.915
Motor	BGT	-10.525	p = 0.002
	PLIC	-6.401	p = 0.170
	WM	-4.297	p = 0.014
	Cortex	1.636	p = 0.455

RESULTS: ND AND CEREBRAL PALSY

75% of the 20 babies who had an adverse neurodevelopmental outcome had a more severe form of cerebral palsy; GMFCS III – V (Figure 5).

Figure 5: GMFCS scores for CP patients

RESULTS: DIAGNOSTIC ACCURACY

Cerebral MRI had a sensitivity 95%, specificity of 94%, PPV 86%, NPV of 98% and accuracy of 94% and is comparable to other published data (Figure 6), with the advantage of this data being based on a UK cohort outside of the clinical trial setting.

CONCLUSION

In babies who have undergone TH, BGT abnormalities on cerebral MRI are predictive of neurodevelopment outcome in clinical practice. Conventional MRI remains a valuable tool providing prognostic information for counselling families. It is also a valid surrogate outcome when used in research studies.

Figure 6: Comparison to other studies

	Sensitivity	Specificity	PPV	NPV	Accuracy
Rutherford et al ¹⁵	0.88 (0.79–0.97)	0.82 (0.72–0.92)	0.76 (0.65–0.87)	0.91 (0.83–0.99)	0.84 (0.74–0.94)
Chalak et al ²²	0.73	0.84	0.84	0.74	N/A
Rollins et al ²³	0.95	0.84	0.84	0.74	N/A
Shankaran ²⁴	0.61	0.92	0.92	0.59	N/A
Weeke et al ⁹ (Cohort 1)	0.923	0.958	0.889	0.971	0.948
(Cohort 2)	0.421	0.982	0.889	0.836	0.842
Trivedi et al ²⁵	0.77	0.46	0.47	0.76	N/A
Our study	0.95 (0.75–1.00)	0.94 (0.83 – 0.99)	0.86 (0.68 – 0.95)	0.98 (0.87 – 1.00)	0.94 (0.86 – 0.98)