TRANSCEREBELLAR DIAMETER AND EXTRACEREBRAL SPACE AT TERM EQUIVALENT AGE ARE RELATED TO 2-YEAR-OUTCOME IN FORMER VERY PRETERM INFANTS WITHOUT BRAIN INJURY

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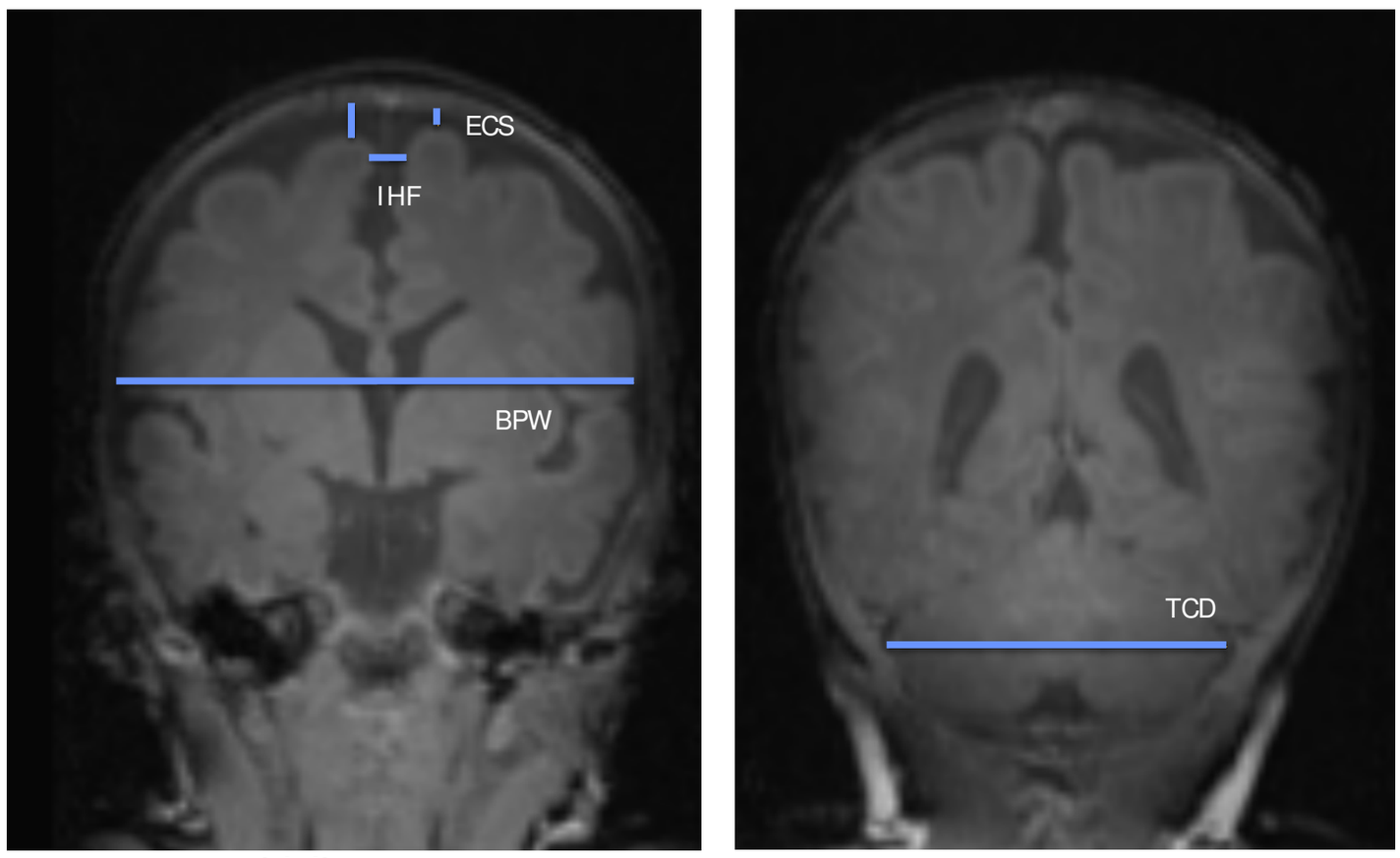
BACKGROUND AND AIMS

There is evidence that the width of extracerebral fluid spaces and the brain size are associated with neurodevelopmental outcome of preterm infants born <32 weeks of gestational age (GA). Linear measurements can be obtained in magnetic resonance imaging (MRI) scans at term equivalent age (TEA). Previous studies on this topic did not exclude infants with brain injury. Since it is known that brain injury affects brain development and growth respectively, we investigated whether the relationship between linear measurements and outcome also pertains to preterm infants without brain injury and if previously published cut-off values are applicable for those infants.

METHODS

All preterm infants <32 weeks of GA born between October 2010 and June 2015 were eligible for the study. MRI was performed in infants <32 weeks of GA at TEA during postprandial sleep. Infants with brain injury (intraventricular haemorrhage, cystic and non-cystic periventricular leukomalacia, cerebellar haemorrhage) were excluded. Extracerebral space (ECS) and inter-hemispheric fissure (IHF) in the frontal area, biparietal width (BPW) and transcerebellar diameter (TCD) were measured in coronal T1-weighted images (cut-off values to be found in table 1). Psychomotor (PDI) and mental developmental index (MDI) at age 2 years were assessed using the Bayley Scales of Infant Development.



▲ **MRI at TEA with linear measurements.**

Table 1. Cut-off values for mild and moderate-to-severe reduction of brain volume and extension of extracerebral fluid spaces.

Variable	Mild	Moderate-to-severe
Biparietal width*	≥72 mm; <77 mm	<72 mm
Transcerebellar diameter*	≥47 mm; <50 mm	<47 mm
Interhemispheric fissure*	<5 mm; ≥4 mm	≥5 mm
Extracerebral space ▲	≤5 mm; >4 mm	>5 mm

** Kidokoro H, Neil JJ, Inder TE: New MR imaging assessment tool to define brain abnormalities in very preterm infants at term. Am J Neuroradiol 2013; DOI: 10.3174/ajnr.A3521*

▲ Maunu J, Parkkola R, Rikalainen H, Lehtonen L, Haataja L, Lapinleimu H: Brain and Ventricles in Very Low Birth Weight Infants at Term: A Comparison Among Head Circumference, Ultrasound, and Magnetic Resonance Imaging. Pediatrics 2009;123:617–626.

Table 2. Linear measurements compared in patients with abnormal vs. normal PDI and MDI.

	PDI abnormal	PDI normal	p-value	MDI abnormal	MDI normal	p-value
TCD	53.1 ± 3.4	54.4 ± 2.5	**0.044**	53.9 ± 2.9	54.3 ± 2.6	0.450
BPW	76.1 ± 5.3	77.4 ± 3.5	0.147	77.6 ± 4.3	77.2 ± 3.7	0.598
ECS right	5.6 ± 2.6	4.5 ± 1.7	**0.014**	4.6 ± 1.7	4.6 ± 1.8	0.990
ECS left	5.7 ± 2.6	4.8 ± 1.6	0.054	5.4 ± 2.2	4.8 ± 1.7	0.075
IHF	3.6 ± 1.3	3.8 ± 1.8	0.595	3.8 ± 1.4	3.7 ± 1.8	0.988

RESULTS

In the final analysis 166 infants without brain injury were included. Mean GA at birth was 29.9 ± 1.8 weeks, mean birth weight was 1317 ± 393 grams. MRI was performed at a mean postmenstrual age of 40.6 ± 0.6 weeks. Mean PDI at two years of age was 101 ± 14.5, while mean MDI was 100 ± 17.4. 11.6% of all former very preterm infants showed a psychomotor impairment, 17.2% had a cognitive delay. Infants with abnormal PDI scores had a smaller TCD and a larger ECS in the frontal area (table 2). If TCD was <50 mm children showed lower MDI (87 ± 24.2 vs. 101 ± 16.9, p = 0.040) and PDI scores (91 ± 11.0 vs. 101 ± 14.5, p = 0.056). Children with a moderate-to-severe extension of ECS also showed lower MDI, with a significant difference only for the left ECS (97 ± 18.8 vs. 103 ± 16.0, p = 0.040). There was no significant relation between BPW or IHF and outcome.

CONCLUSIONS

There is a significant relationship between neurodevelopmental outcome at two years of age and extension of extracerebral fluid spaces and reduction of cerebellar size already at TEA. Previously published cut-off values also included infants with brain injury, which could explain that in our study no relationship between BPW or IHF and outcome was found, as brain injuries also have an impact on brain size. Not all previously published cut-off values are applicable for infants without obvious brain injury. Cut-off values for uninjured brains are needed to strain out children without brain injury who are at a higher risk for adverse outcome to offer optimal support to them.

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