

Volumetric changes in the hippocampus and relationship to memory indices in children with Hyperinsulinaemic hypoglycaemia and Ketotic hypoglycaemia



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Background and Objective

Children with hyperinsulinaemic hypoglycaemia (HH) are at a high risk of brain injury, while children with ketotic hypoglycaemia (KH) are believed to be neurologically normal. Hippocampus is known to be susceptible to hypoglycaemia, and is one of the key structures in the memory system. Our objective was to ascertain if children with HH sustain greater hippocampal injury and memory deficits in comparison to children with KH.

Methods

20 neurologically normal children between 5-16 years of age with HH and 14 children with KH were recruited from the endocrine and metabolic outpatient clinics from 2009-2012. Cognitive assessment was performed using Wechsler Intelligence Scale for Children Fourth edition and Children Memory Scale. Conventional (T1, T2 weighted) MRI for visual inspection of hippocampus and fast low angle shot (FLASH) three-dimensional MRI for manual hippocampal volume measurement were acquired. The FLASH data was analyzed with MEDx, version 3.3 (Sensor Systems Inc., VA). Each hippocampal slice, 1 mm in thickness, was manually traced.

Results

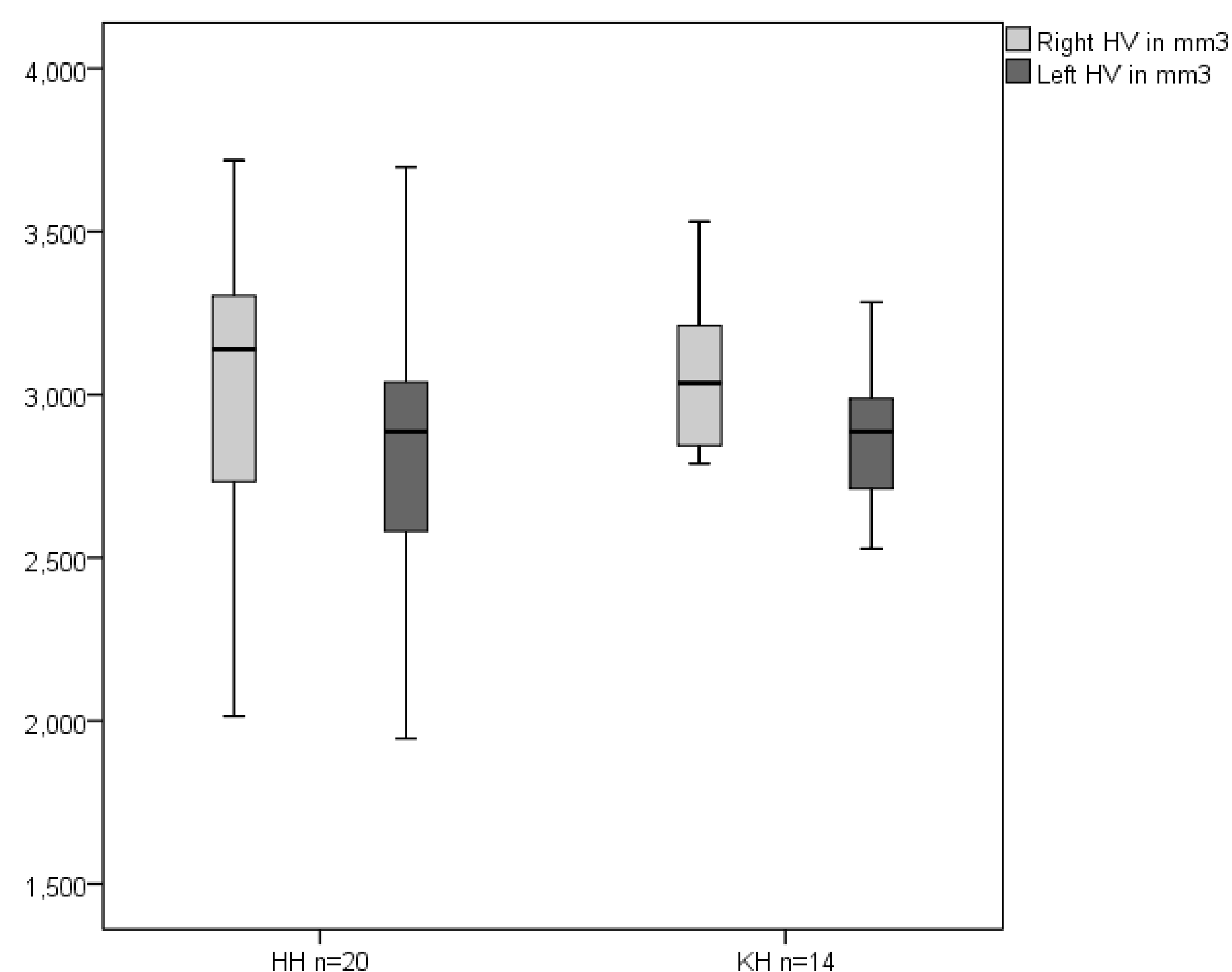
Baseline characteristics of the patients are as follows

Patient characteristics	HH	KH	p-value
Number of patients	20	14	
Age at scan in years (mean ± SEM)	10.3 (2.6)	8.7 (2.1)	0.073
Gender (Male/female)	13M/7F	9M/5F	0.96
Gestational age in weeks	39.3	38.7	0.42
Birth weight in grams (mean ± SEM)	3870.5 (898.7)	3337.2 (747.4)	0.069
Handedness (Right/Left)	15R/5L	11R/3L	1.000
Height sds (median)	-0.06 (0.8)	-0.05 (0.6)	0.703
Weight sds (median)	0.09	-0.17	0.287
Seizures at diagnosis (n)	9	3	0.27

Conclusions

Children with HH manifest significant impairment of memory, however they do not correlate with hippocampal volumes. Further studies are required to determine the neural substrate underlying these memory impairments.

Comparison of Hippocampal volumes (HV) between children with HH and KH



On conventional MRI, small hippocampi were seen in 28.5% (n=6) with HH and 7% (n=1) with KH

Hippocampus Volume	HH (n=20)	KH (n=14)	(KH vs HH) p-value
Right (median) mm ³	3138.36	3035.19	0.959
Left (median) mm ³	2887.22	2887.09	0.877

Memory indices and IQ

Comparison of mean scores, Children Memory scale (CMS) and Intelligence Quotient (IQ) between HH and KH, are as follows

CMS Index scores	HH	KH	p value
Visual Immediate	94.8	106.3	0.022
Visual Delayed	97.5	104.5	0.093
Verbal Immediate	94.9	110.5	0.006
Verbal Delayed	97.2	108.7	0.055
General Memory	93.1	110	0.002
Learning index score	91.3	107	0.005
Full scale IQ	89.3	100.5	0.028

Hippocampal volumes did not correlate to memory indices in HH group. 3 children in the HH group had > 20-25% reduction in bilateral hippocampal volumes, however only one child had impaired memory.

References

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