

Brain MRI and neurocognitive characteristics of children with perinatal HIV infection in Russia: a retrospective cross-sectional study

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BACKGROUND

Russia is one of the most affected countries of the HIV epidemic in the Eastern Europe and Central Asia (EECA) region, and the number of children living with HIV remains substantial. About 10 thousand children with HIV infection live in Russia and about 250 children become infected a year (1). This study aims to describe the neurocognitive, neuroradiological and associated clinical characteristics of children and adolescents with perinatal HIV attending a tertiary paediatric HIV clinic in Russia.

METHODS

A cross-sectional pilot study was conducted in the Republican Hospital for Infectious Diseases (RHID) in Saint Petersburg from September 2013 to July 2015. Socio-demographic and clinical data were collected through the European Pregnancy and Paediatric HIV Cohort Collaboration (EPPICC) database.

40 consecutive children/carers in routine follow up were approached to undergo Brain MRI imaging and cognitive function assessment. Brain MRI images which were independently reviewed by two experienced radiologists. Cognitive function assessment was carried out using the Russian version of the Wechsler Intelligence Scale for Children (WISC-III).

The study was included to and received funding from the REACH project (the European Union's Horizon 2020 grant no. 825579).

RESULTS I. Patient Characteristics (n=38[§])

HIV-related characteristics (n=38)	Median [IQR] or n (%)
Sex, female	20 (52.6%)
Born preterm	2 (5.3%)
Living in an institution (e.g. orphanage)	5 (13.1%)
Age at HIV diagnosis (months)	21.5 [9.5-34.5]
Age at ART initiation (months)	56.5 [31.8-98.3]
Characteristics at MRI / WISC assessment*	
Age (years)	10 [8-12]
History of AIDS diagnosis	7 (18.4%)
History of encephalopathy diagnosis	4 (10.5%)
CD4 cell count (cells/mm ³), n=36	722 [578.25-1082]
HIV RNA viral load <400 copies/ml, n=36	29 (80.6%)
Duration on ART (years)	4 [2.25-8]

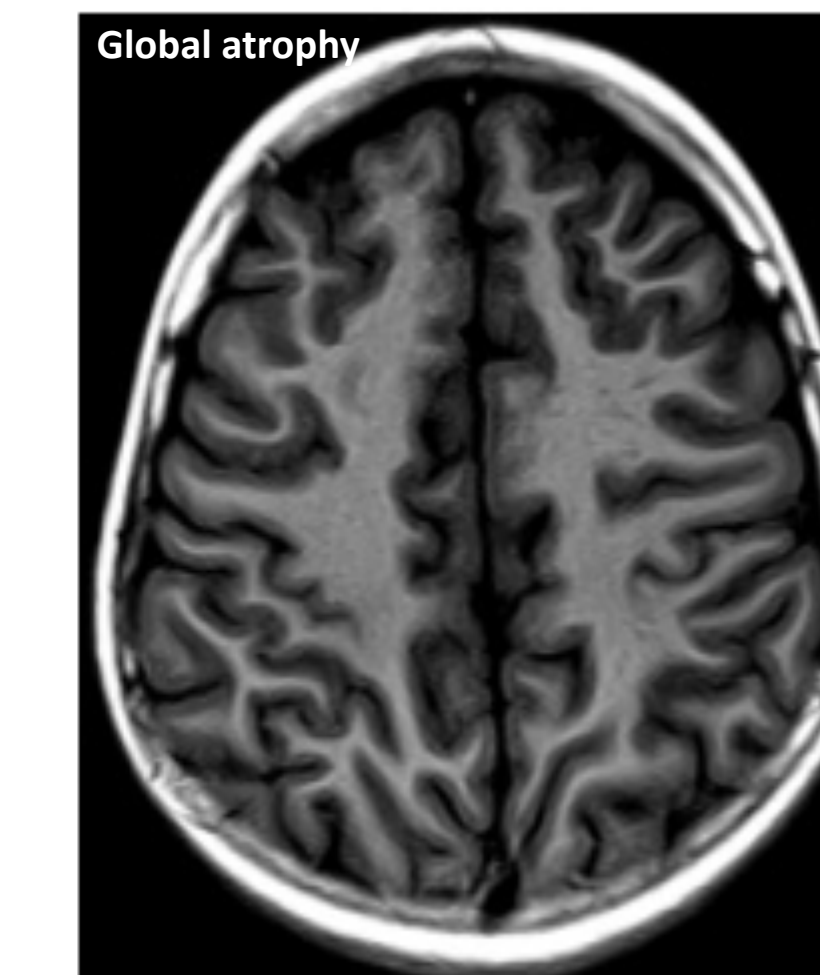
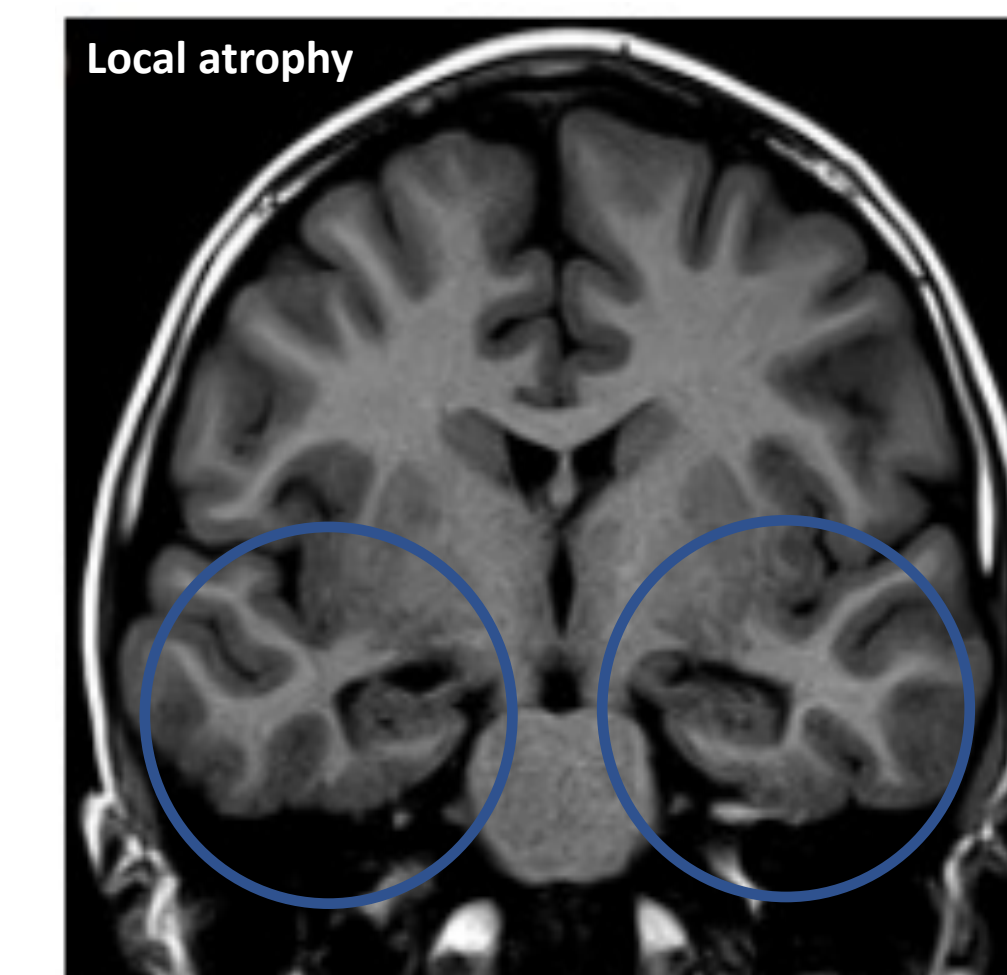
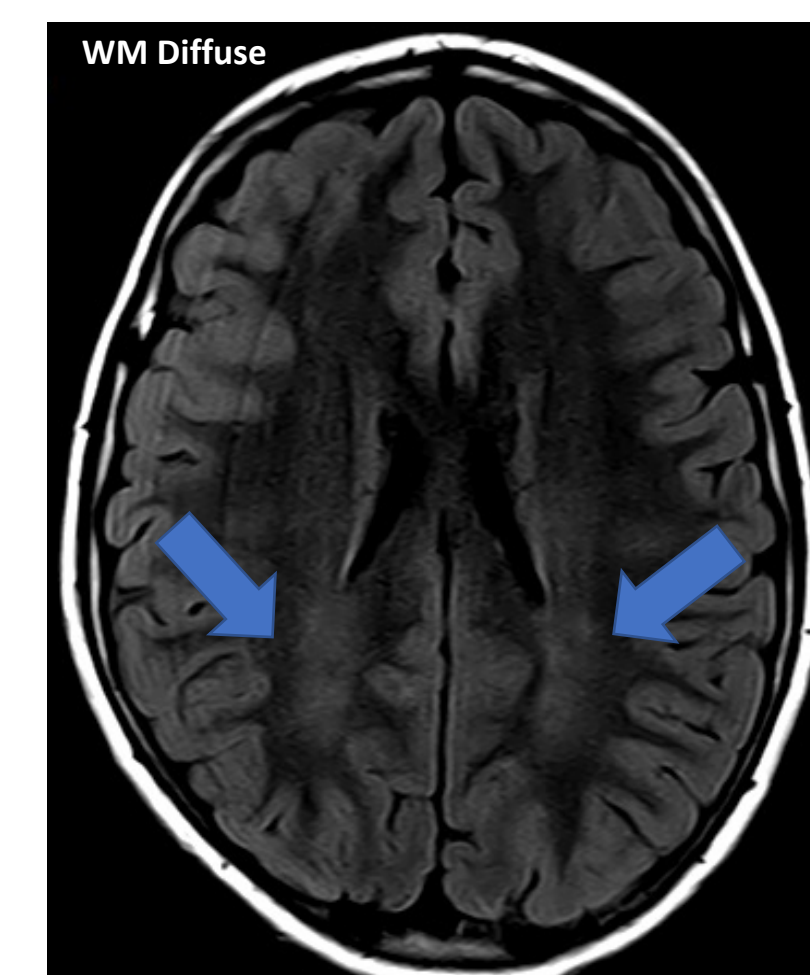
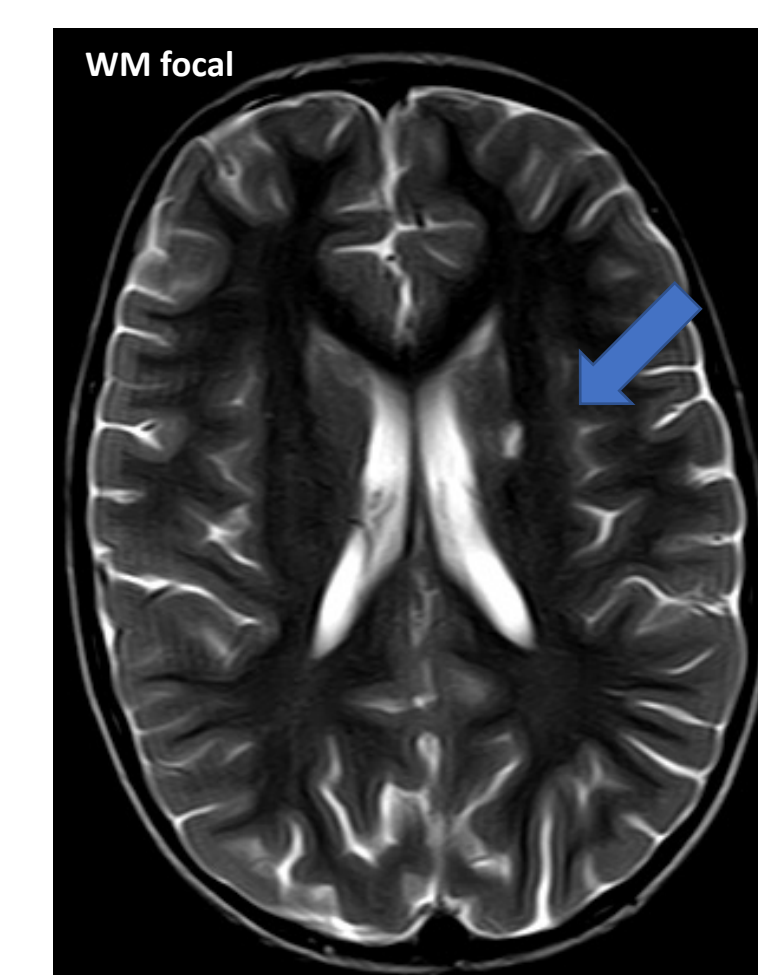
[§]The data on 2 participants are being verified
*For time related characteristics, the date of the earliest assessment taken

Over a quarter of children had neuroradiological abnormalities, however, most had IQ scores within the average range.

There was a trend towards older age at ART initiation among patients with MRI abnormalities.

RESULTS II. Neuroradiological Results (n=34)

White matter focal changes	White matter diffuse changes	Local atrophy	Global atrophy	Any MRI abnormality
8 (23.5%)	5 (14.7%)	4 (11.8%)	3 (8.8%)	15 (44.1%)



RESULTS III. Cognitive Function Results (n=39)

WISC-III Subtest/Indexes	Mean	SD
Full Scale IQ	99.1	15.8
Verbal IQ	97.3	17.7
Information	9.4	3.7
Comprehension	13	4.4
Vocabulary	7.1*	5
Similarities	11.2	3.4
Arithmetic	8.5	3.3
Digit Span	7.6*	2.4
Performance IQ	101.8	14.7
Picture Completion	10.7	4.2
Coding	9.8	3.8
Picture Arrangement	10.1	3.1
Block Design	10.6	3.8
Object Assembly	9.4	2.4
Mazes	11	3

*The average range was defined as 90 to 110 for IQ indexes (verbal, performance and full-scale) and 8 to 12 for cognitive subtest scores.

WISC-III Full Scale IQ Classification	n	%
Very Superior (≥ 130)	0	0
Superior (120-129)	4	10.3
High average (110-119)	9	23.1
Average (90-109)	17	43.6
Low average (80-89)	4	10.3
Borderline (70-79)	3	7.5
Intellectually deficient (≤ 69)	2	5.1

ACKNOWLEDGEMENTS:

We thank all families and patients taking part in this study, as well as the staff at the RHID. **Funding:** This project has received funding from the European Union's Horizon 2020 (No 825579)

RESULTS IV. Neuroradiological & Cognitive Function Results

Of 34 participants with available MRI scans, 8 (23.5%) participants had ≥1 focal supratentorial white matter (WM) lesions on MRI. Five (14.7%) children had diffuse WM hyperintensity lesions on T2/FLAIR suggestive of leukoencephalopathy, 4 (11.8%) global atrophy and 3(8.8%) had mild global atrophy. Mean(SD) WISC-III IQ scores were available on 39 participants and they were within the accepted average range: verbal 97.3 (17.7), performance 101.8(14.7), full scale 99.1 (15.8). Five (12.6%) participants had a full-scale IQ score below 80. Mean(SD) subtests scores were in the average range on all but two subtests: vocabulary 7.1(5) and digit span 7.6(2.4).

RESULTS V. Comparison of patients characteristics and cognitive scores by the presence or absence of brain MRI abnormalities

	NO abnormalities N=19	Abnormalities* N=13	P-value [§]
	N (%), Median [IQR]		
Age at ART initiation (years)	3.87 [2.20-6.79]	6.6 [3.1-8.04]	0.09
Age at assessment (years)	9 [6.5-11]	11 [9.25-12]	0.13
Prior AIDS diagnosis			≈ 1
- No	15 (88%)	11 (92%)	
- Yes	2 (12%)	1 (8%)	
CD4 %	33 [24.5-39]	31 [25.2-40]	0.89
Total IQ	107 [94.2-116.2]	99 [91.5-111]	0.49
IQ			0.75
< 80	2 (11%)	1 (8%)	
≥80	16 (89%)	12 (92%)	
Verbal IQ	107.5 [89.7-114]	95 [85.5-108]	0.45
Performance IQ	105 [99-118]	99 [90-111]	0.51

*Two patients with history of HIV-encephalopathy were excluded from this analysis. [§] Chi-square tests: Fisher and t-tests as appropriate.

CONCLUSIONS

Over a quarter of children had neuroradiological abnormalities but most had IQ scores within the average range. There was a trend towards older age at ART initiation among patients with MRI abnormalities. Further studies are needed to confirm these findings. Brain MRI and WISC assessments may help to identify children in need of developmental support and ART optimisation.

REFERENCES:

1. Voronin E. HIV-infection in children: new challenges. International scientific and practical conference on topical issues of HIV infection: protection of mother's and child's health. 31 May- 1 June 2021. St Petersburg, Russia