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QUALITATIVE AND QUANTITATIVE BRAIN MRI AT TERM CORRECTED AGE IN CHILDREN BORN BEFORE 32 WEEKS OF GESTATION

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BACKGROUND

Brain Magnetic Resonance Imaging (bMRI) of very preterm children (VPT) at term corrected age (TEA) is an early prognostic assessment tool for neurodevelopmental outcome. The aim of the study is to describe qualitative and quantitative brain abnormalities observed at TEA in a monocentric cohort of VPT born before 32 gestational weeks (GW).

METHODS

VPT born < 32 GW at the Reims University Hospital, with TAE bMRI were included from January 1st 2009 to December 31st 2011.

A standardized reading grid with 9 qualitative items and 19 2D quantitative measures was used (**Figure 1**). The population was studied divided into 4 subgroups according to the terms :

"24 to 26 GW", "27 to 28 GW", "29 to 30 GW" and "31 to 32 GW".

Severe qualitative abnormalities were defined as the presence of extensive cystic or multiple nodular lesions of white matter (WM), extensive lesions of grey matter (GM), basal ganglia (BG) or cerebellum and HIV 3-4 **(Figure 2).**

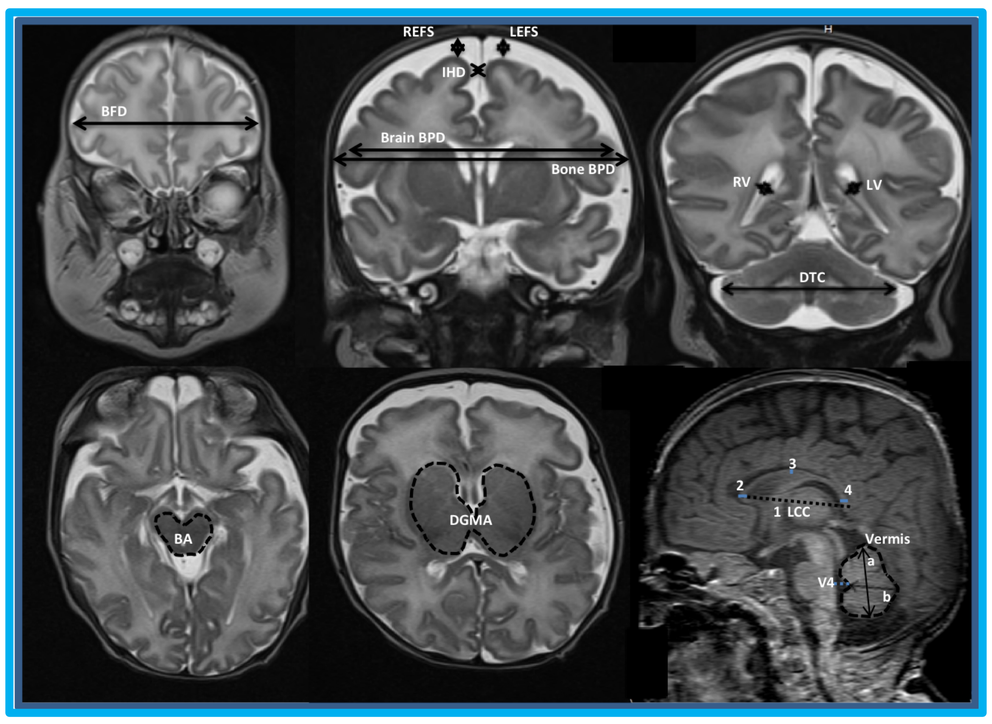

Figure 1. Anatomical landmarks of 19 quantitative regional measurements: bifrontal diameter (**BFD**), brain biparietal and bone biparietal diameters (**brain and bone BDP**), right/left extrafluid spaces (**R/L EFS**), inter-hemispheric diameter (**IHD**), right/left ventricles (**R/L V**), transverse cerebellar diameter (**DTC**), brainstem area (**BA**), deep grey matter area (**DGMA**), length (**LCC**) and genu (**2**), corpus (**3**), splenium (**4**) widths of corpus callosum, diameter of the fourth ventricle (**V4**), height (**a**), antero-posterior diameter (**b**) and area of the vermis.

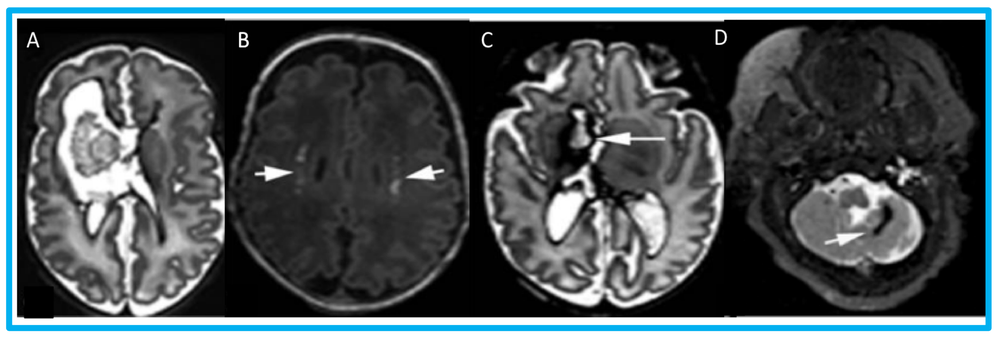

Figure 2. Severe qualitative abnormalities: extensive cystic (A) and nodular (B) white mater injuries, extensive basal ganglia (C) and cerebellar (D) injuries.

RESULTS

- One hundred and three TAE bMRI scans were performed and 103 patients included.
- In VPT born < 28 GW, bMRIs showed abnormalities with 22.2% (n=4/15 MRIs) of isolated quantitative abnormalities and 77.8% (n=14/18) of both quantitative and qualitative abnormalities. In VPT born > 28 AS, 2% (n=2 out of 85) bMRI were normal, 2% (n=2/85) had isolated qualitative abnormalities, 42.9% (n=36/85) isolated quantitative abnormalities and 52.9% (n=45/85) qualitative and quantitative abnormalities **(Figure 3).**
- Quantitative 2D measures increased with gestational age, with a statistical difference of the bifrontal diameter (BFD), the transverse cerebellar diameter (TCD), the brainstem area (BA) and the deep grey matter (DGMA) between the two opposite gestational age groups **(Figure 4).**
- In the severe qualitative abnormalities group, quantitative brain measurements were significantly decreased compared to the group without severe qualitative abnormalities **(Table 1).** Qualitative abnormalities, including severe ones, were mainly present in the most immature group of children "24-26 GW". Cerebellum growth impairment is associated with qualitative cerebellar and/or cortical qualitative abnormalities (results not shown).

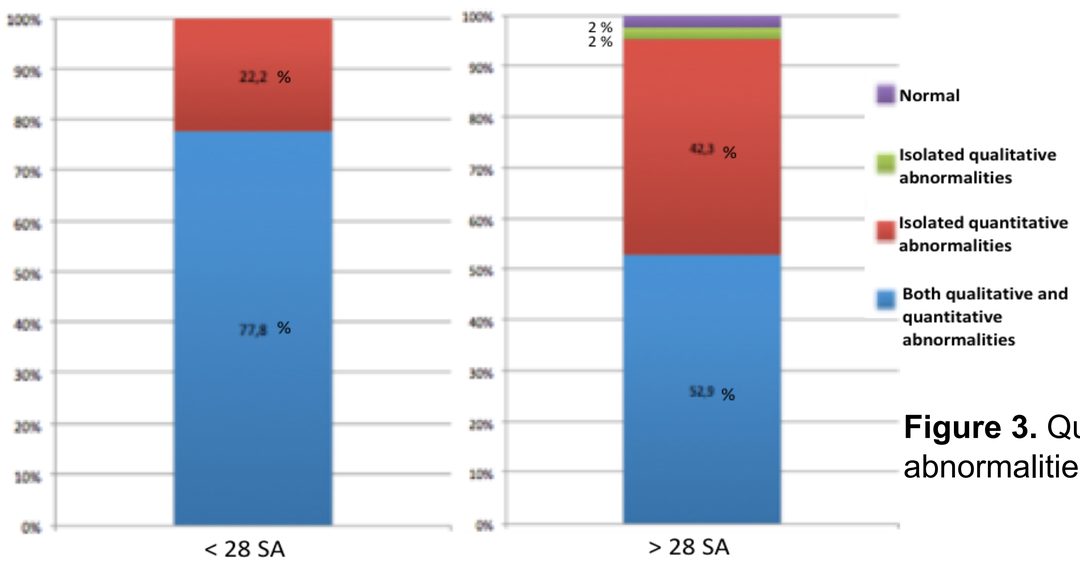

Figure 3. Qualitative and quantitative abnormalities distribution.

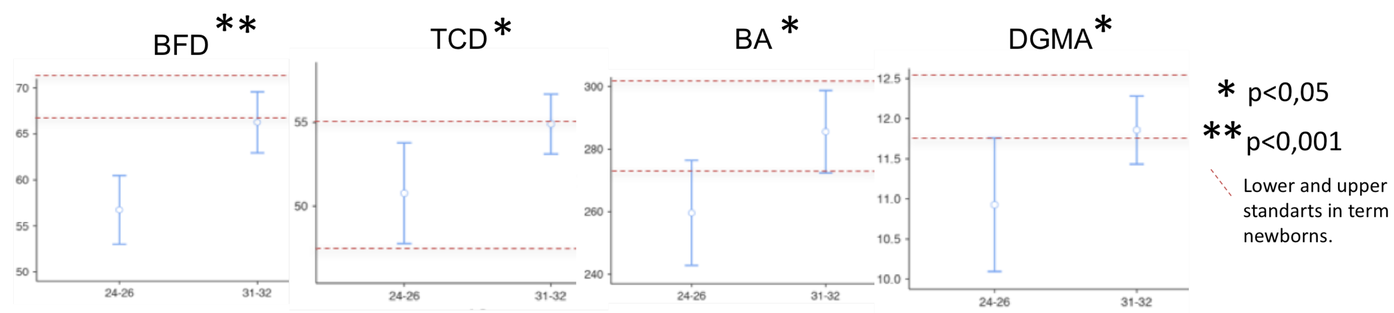

Figure 4. Quantitative measurements comparisons between the "24-26 GW" and the "31-32 GW" subgroups.

	Group 1 Severe qualitative abnormalities		Group 2 Without qualitative abnormalities		p
	n	Mean (SD)	n	Mean (SD)	
BFD (mm)	11	59 (8,7)	82	63 (7,6)	0,02
TCD (mm)	12	46,9 (5,7)	82	54,1 (4,3)	< 0,001
Vermis area (cm2)	12	3 (0,8)	90	3,8 (0,6)	< 0,001
Vermis height (cm2)	12	24,1 (4)	91	26,4 (2,6)	< 0,001
Vermis AP (mm)	12	14,6 (2,2)	91	16 (1,9)	0,003
DGMA (cm2)	12	9,9 (1,3)	91	11,9 (1,3)	< 0,001
BA (mm2)	12	235 (30)	91	284 (30)	< 0,001
LCC (mm)	8	36,3 (38)	91	40,1 (4,1)	< 0,001
WCC (mm)	8	2,4 (0,7)	91	2,8 (0,6)	0,03
LV(mm)	12	15,3 (10)	82	6,3 (1,6)	< 0,001
RV (mm)	12	13,5 (9,3)	82	6,3 (1,6)	< 0,001

Table 1. Quantitative measure comparisons in presence of severe qualitative abnormalities.

CONCLUSION

Brain qualitative and quantitative abnormalities are frequent in VPT. Quantitative abnormalities are mostly associated with qualitative brain lesions but may be isolated. Cerebellum growth is particularly affected for this cohort. To correlate the long-term neurodevelopment at 2, 5 and 11 years of age is a perspective study of this cohort.

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