Characterization of Oligodendrocyte Precursor Cell Migration During Corticogenesis

Introduction

The oligodendrocyte precursor cells (OPCs) are derived from distinct progenitor pools. The two first cohorts are born in the ventral forebrain. The first one is generated at E11.5 in the medial ganglionic eminence (MGE) and the preoptic area (POA) and the second one around E16.5 in the lateral ganglionic eminence (LGE). There is an additional wave of OPCs born at birth in the pallium. While the origin of OPCs has been well described, their migration mode remains poorly understood. In the present study, we performed time-lapse video microscopy to quantify the migration parameters of OPCs at E13.5 and E16.5. We also compared the migration parameters of OPCs generated in the two first generation waves with the migration parameters of cortical interneurons, a cell population that migrates concomitantly with OPCs. We further investigate the interactions between embryonically generated-OPCs and other structures as blood vessels, meninges and fibers.



Conclusions

- the cortical plate using the vasculature, following a ventro-dorsal pattern of invasion.

Fanny Lepiemme¹, Carla G. Silva^{1*} and Laurent Nguyen^{1*}

¹GIGA-Stem cells / GIGA-Neuroscience, Interdisciplinary Cluster for Applied Genoproteomics (GIGA-R), University of Liège, C.H.U. Sart Tilman, Liège B-4000, Belgium

OPCs and interneurons concomitantly invade the cortical plate using distinct migration parameters. OPCs migrate by performing less discontinuous movements. This difference is not related to the fact that OPCs migrate along the vasculature, suggesting that OPCs mode of migration is intrinsically regulated. OPCs interact and migrate on various substrates. At E12.5, early generated-OPCs migrate in an organized stream in the cortical parenchyma, along the meninges. At E13.5, OPCs/ blood vessels interaction is more frequent and their movement is erratic. At E16.5, OPCs are mainly organized on thalamocortical fibers and migrate into

fn^rs

🖌 GIGA institute



2. MIGRATION PROFILE OF OPCS AND ITS INTERACTION WITH VESSELS AND FIBERS IN THE PALLIUM



1. (A) Transgenic mouse models used in this study. OPCs are identified by the expression of the green fluorescent protein GFP under the control of Sox10 promotor. Interneurons are identified by the expression of the green fluorescent protein GFP under the control of Dlx5,6 promotor. (B) Time-lapse sequence showing the distribution of OPCs or INs (green) in the cortical plate of organotypic brain slices prepared at E13.5 or E16.5. (C-F) Histograms comparing the average speed (C), frequency of nucleokinesis (D), amplitude of nucleokinesis (E) and total time of nuclear pause (F) of OPCs and interneurons at E13.5 and E16.5. 2. (G) Panels showing interaction between OPCs (green) and blood vessels (stained with IsolectineB4-Cy5, pseudocolor purple) at different embryonic stages. Red arrowheads indicate OPCs migrating along blood vessels and blue arrowheads indicate OPCs migrating without contacting with blood vessels. (H) Quantification of the percentage of OPCs migrating along blood vessels at E12.5, E13.5 and E16.5. (I) Representative scheme of migration of OPCs at E13.5. At this stage, some OPCs migrate continuously on blood vessels (1), others migrate without interacting with blood vessels (2), or alternating between blood vessels and cortical parenchyma (3). (J-L) Histograms comparing the average speed (J), frequency of nucleokinesis (K) and amplitude of nucleokinesis (L) of OPCs migrating (red) or not (turquoise) on blood vessels at E13.5. (M) Immunohistochemistry showing the localization of OPCs (green) in the forebrain at E12.5, E14.5 and E16.5. The early generated-OPCs form a migratory stream along the meninges at E12.5 and continue to migrate along this structure until reaching the corpus callosum (CC) at E14.5 (yellow stars). At E14.5 and E16.5, OPCs are strongly localized on fibers (cyan stars and triangle; staining of NCAM-L1, red). GEs = ganglionic eminences, CC = corpus callosum, AC = anterior commissure. (N) Immunohistochemistry showing an accumulation of OPCs (green) in brain areas occupied by thalamocortical fibers (red) at E16.5. The magnified regions show a ventro-dorsal gradient of cortical plate invasion by OPCs interacting with blood vessels (pseudocolor purple).



